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HOW TO MAKE A DYNAMO-ELECTRIC MACHINE, WITH WORKING DRAWINGS ONE-HALF ACTUAL SIZE.

By Geo. M. Hopkins.

Probably the most important invention following the discovery of magneto-electrical induction is the dynamo-electrical machine, which is now made in many forms, all of which are based on the same general principle, viz.: the rotation, within the influence of the poles of a magnet, of a soft iron armature surrounded by one or more helices, an electrical current being produced in the helices by the rapid magnetization and demagnetization of the soft iron armature.

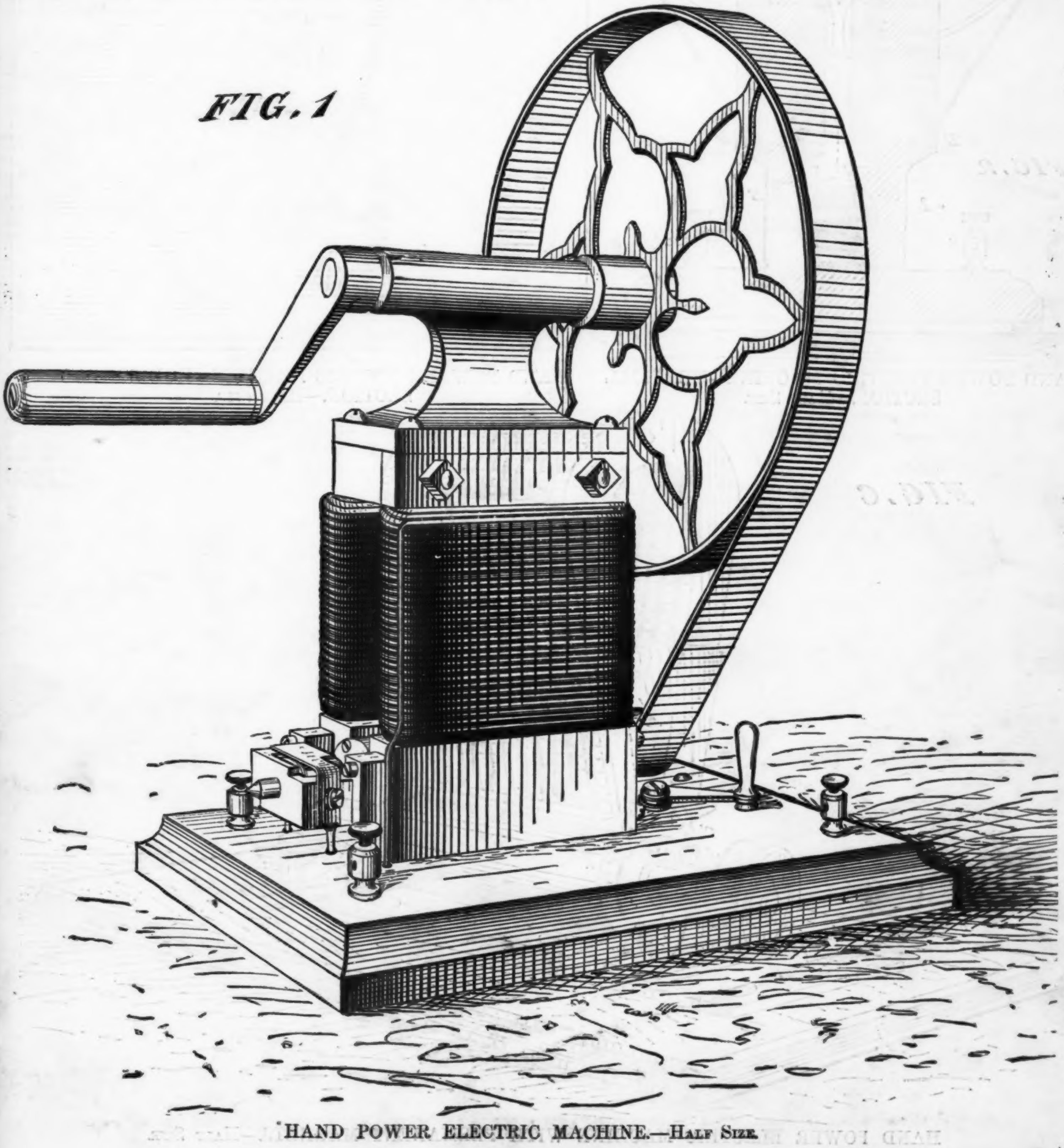
While several of the principal machines seem to stand on about the same footing in regard to efficiency, none of them can be more easily made than the Siemens; and I do not think a small machine of any other type would give better satisfaction than the ones described in this article.

It is not necessary to use permanent magnets in this machine. Electro-magnets may be employed, the slight residual magnetism of the soft iron cores serving to excite the armature, which in turn excites the magnet, thus multiplying the magnetic induction until a strong current is realized.

In the accompanying engravings, which are exactly one half size, Fig. 1 is a perspective view of a dynamo-electric machine having electro-magnets and a Siemens armature. Fig. 2 is a vertical transverse section taken on line *y y* in Fig. 3. Fig. 3 is a horizontal section, taken through the electro-magnet looking downward. Fig. 4 is a vertical longitudinal section of the armature and its commutator, taken on line *x x* in Fig. 2. Fig. 5 is a transverse section of the commutator and commutator springs, taken on line *s s* in Figs. 3 and 4. Fig. 6 is a perspective view of a dynamo-electrical machine employing permanent magnets. Fig. 7 is an end elevation of the same, and Fig. 8 is a perspective view of this machine, showing the manner of driving it. As the dimensions of either machine may be obtained from the drawings, I shall omit them in the description.

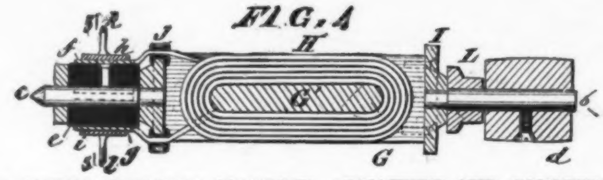
The electro-magnet is, for the sake of convenience, composed of two pieces, A B, which are exactly alike excepting that the connecting piece, C, is cast with the piece, A. The parts, A B, are planed at their juncture at the top, and secured together by two bolts which pass through the part C. The lower ends of these parts are also planed to receive the brass plate, E, which is secured in place by dowels and screws, two of each entering each part. The cylindrical cavity which receives the armature, G, is bored out truly

FIG. 1



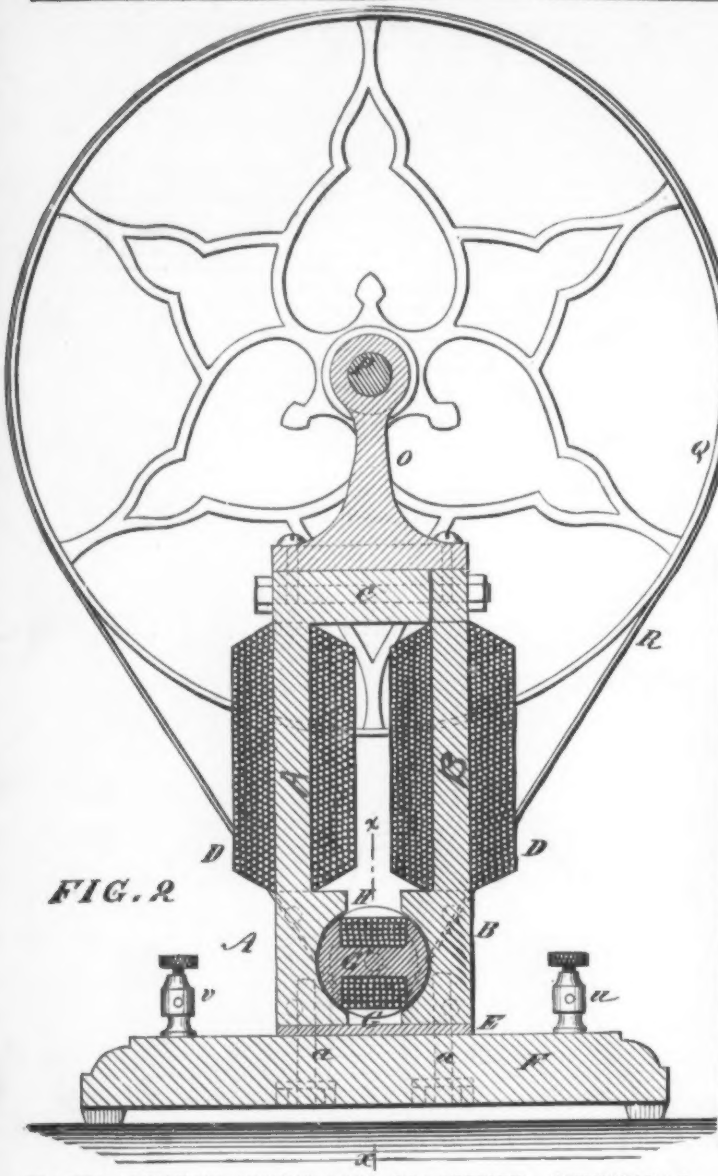
HAND POWER ELECTRIC MACHINE.—Half Size.

FIG. 4



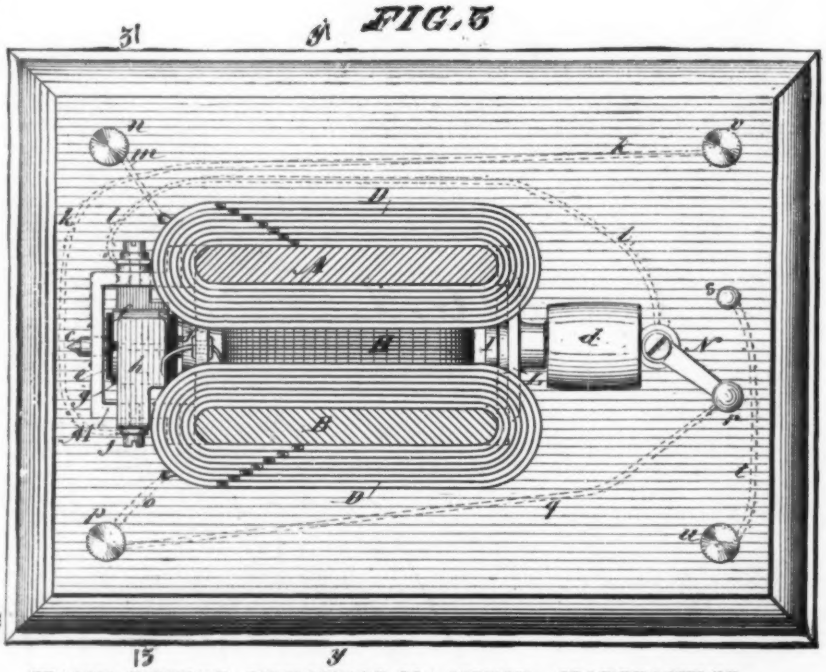
HAND POWER ELECTRIC MACHINE—ARMATURE AND COMMUTATOR.

FIG. 2



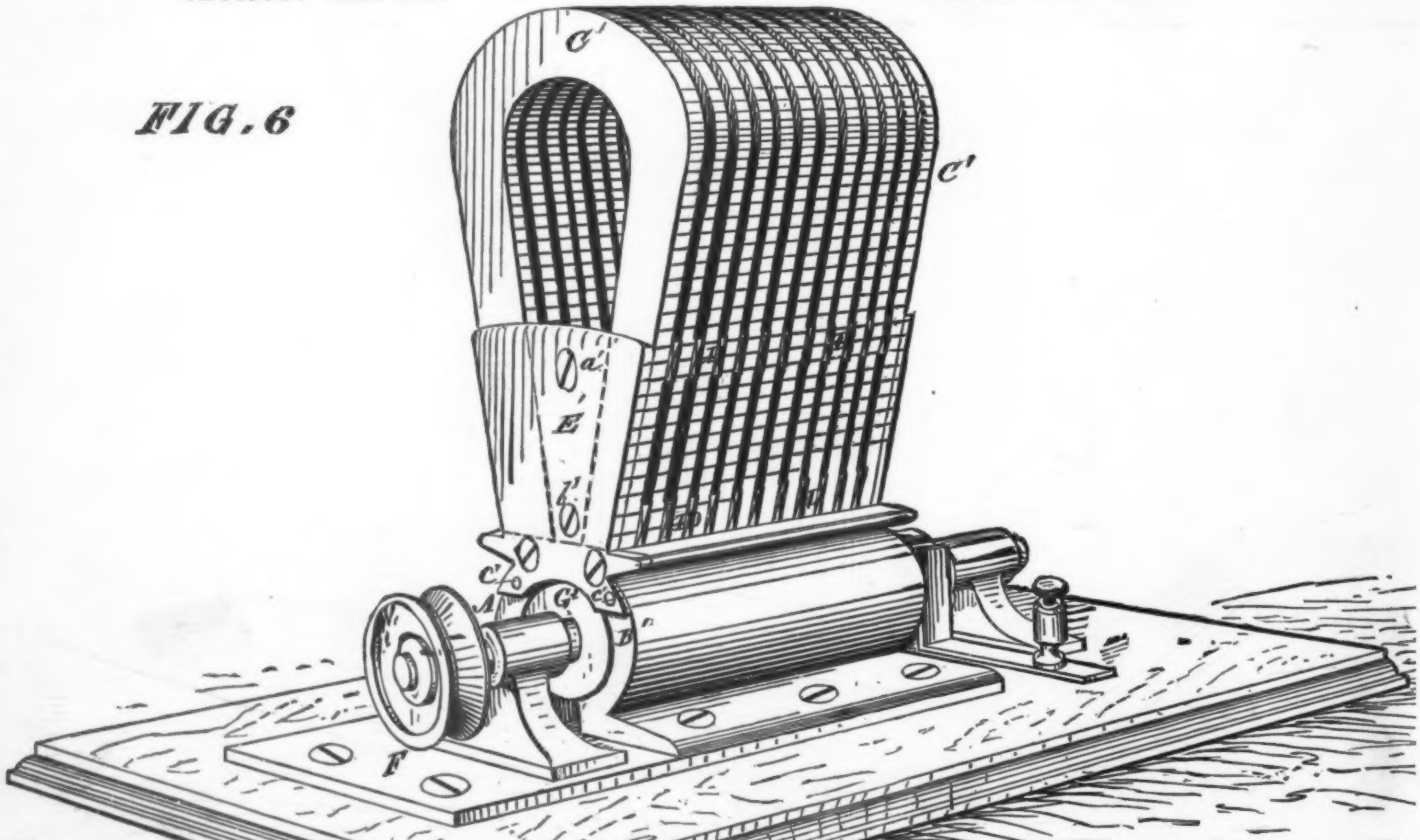
HAND POWER ELECTRIC MACHINE—VERTICAL SECTION.—Half Size.

FIG. 3



HAND POWER ELECTRIC MACHINE—HORIZONTAL SECTION.—Half Size.

FIG. 6



HAND POWER ELECTRIC MACHINE WITH PERMANENT MAGNETS.—Half Size.

and smoothly of a uniform caliber from end to end. The edges of that portion of the electro magnets around which the wire, D, is wound are rounded, as shown in Fig. 3. Before winding, a piece of cotton factory cloth should be wrapped around each core ; upon this is wound seven layers of No. 16 cotton-covered copper wire. The limbs of the magnets should be wound in opposite directions, or in such a way that when the two portions, A B, are placed end to end, one coil would be simply a continuation of the other. The inner ends of the coils are connected together, while their outer ends are of sufficient length to run downward through the base, and bent outward at *m o*, and are connected with the binding posts, *n p*.

The armature, G, consists of a cylindrical piece of soft cast iron grooved longitudinally and across the ends, and wound with No. 18 cotton or silk covered copper wire. It

j. The spring, *h*, is bent forward over the commutator and bears upon it with a slight pressure. The spring, *i*, is bent so that it touches the commutator at a point diametrically opposite the contact point of the spring, *h*. To the spring, *h*, a wire (No. 14) is soldered, and extends downward through the wooden base of the machine ; a similar wire runs from the spring, *i*. As the design of this machine is such that its magnet may be connected with a battery, so that all of the current from the armature may be utilized, instead of allowing a portion of it to pass through the helices of the magnet, two extra binding posts, *u v*, and a switch, N, are added.

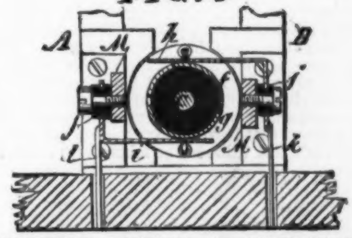
The connections under the base are as follows : The terminals, *m o*, of the electro magnet are connected with the binding posts, *n p*. The commutator spring, *h*, is connected by the wire, *k*, with the binding post, *v* ; the commutator

net and armature may be varied for some special purpose, but for general use the sizes here given are recommended. The slit in the commutator should be made slightly diagonal, so that one section of the copper ferrule will touch the spring before the other section leaves it. The armature should fit in the magnet as closely as possible without rubbing. The parts indicated as brass or copper should be made of these metals, as a magnetic insulation is required wherever they are used.

When the switch, N, is in the position shown in the drawing, the binding posts, *n v*, being connected by a wire, the current passes from the post, *v*, through the commutator and the armature, thence by the wire, *l*, to the switch, thence through the button, *r*, and by the wire to the post, *p*, thence through the electro magnet to the post, *n*, through the terminal, *m*. When the machine is arranged in this manner the wires leading from the machine are taken from the posts, *v n*. The full power of the machine is developed an instant after the connection of the posts, *v n*.

By moving the switch, N, into contact with the button, *s*, and connecting a battery of six or eight Bunsen elements with the posts, *n p*, the magnets are excited without detracting from the power of the armature, and the current from the latter is taken through the wire, *k*, as before, to the post, *v*, but the wire, *l*, is now in electrical connection with the binding post, *u*, through the switch, N, button, *s*, and wire,

FIG. 5



TRANSVERSE SECTION OF COMMUTATOR.

t; therefore the current is taken away from the machine by inserting wires in the posts, *u v*.

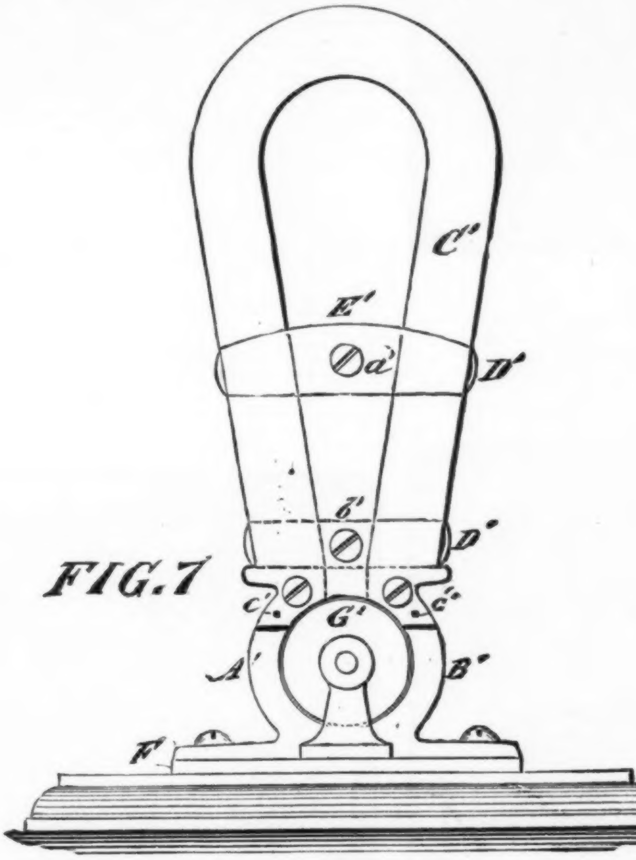
When not connected with a battery this machine will heat from four to six inches of No. 36 platinum wire. It will rapidly decompose water by dipping the ends of the wires in water slightly acidulated. It will run an induction coil, and produce an electric light between two fine carbon points when arranged as in the apparatus described in SUPPLEMENT No. 149. The machine affords a current sufficiently intense to give strong shocks. By connecting it with a helix or electro magnet, small permanent magnets may be charged, and it answers an admirable purpose for ringing large gongs. The effect may sometimes be increased by interposing a resistance of two or three ohms between the binding posts, *n v*. This is especially the case when the apparatus with which it is connected is of the vibratory kind. It may be connected with a small electric motor, giving a striking example of the conversion of force into electricity and of the development of power from the electrical current thus generated. For many purposes this machine will be found equal to six or eight Bunsen cells.

When a battery is employed to excite the electro magnet the effect is very much increased. For example, it will then heat twelve inches of platinum wire instead of four or six inches, and it will afford a current sufficient for a strong electric light.

The speed has much to do with the efficiency of the machine. The writer advises a speed of from 1,200 to 1,500 turns of the armature per minute. The drive wheel in the example given may with advantage be made much larger, say two feet in diameter, where space is not considered. The construction of the machine shown in Figs. 6, 7, and 8 will be readily understood after what has already been said.

The armature is precisely the same as in the other case, and so is the commutator, the only difference being that the armature is wound with No. 20 wire and the slits in

FIG. 7



END VIEW.—HALF SIZE.

is, in fact, a very short and wide bar electro magnet, having enlarged and elongated ends of the form of a segment of a cylinder. In diameter the armature is only a very little less than that of the cylindrical space between the parts, A B, of the electro magnet, and its length is a little less than the width of the electro magnet. In Figs. 2 and 4, G' is the core of the armature around which is wound the wire, H. To opposite ends of the armature are fitted the brass heads, I J, into which are screwed the shafts, *b c*. It will, of course, be understood that the armature needs filing around the core, G', and that the heads and shafts must be fitted to the ends of the armature before it can be turned and fitted to the cylindrical space in the electro magnet. The shaft, *b*, is journaled in a brass support, L, which is attached by screws to the edges of the parts, A B, of the electro magnet. The shaft, *c*, is journaled in a similar support, M, which is secured to the opposite side of the electro magnet. Outside of the bearing, L, upon the shaft, *b*, is secured the pulley, *d*, and between the support, M, and the head, J, the commutator is placed upon the shaft, *c*. The commutator consists of a vulcanite cylinder, *e*, having upon its periphery a copper or brass ferrule, which is slit longitudinally at diametrically opposite points, forming the insulated segments, *f g*. These are secured to the vulcanite cylinder by small brass screws, and the slits are placed exactly opposite the center of the longitudinal grooves in the armature. The commutator is prevented from turning on the shaft by a set screw, and with the segments, *f g*, are connected the terminals of the armature coil, H. These terminals pass through holes in the head, J, which are lined with an insulating material.

To opposite sides of the support, M, are secured the copper commutator springs, *h i*. They are both secured by screws, and insulated from the support by vulcanite buttons,

spring, *i*, is connected with the switch, N, by the wire, *l*. The switch button, *r*, is connected with the binding post, *p*, by a suitable wire, and the switch button, *s*, is connected with the binding post, *u*, by the wire, *t*. All of these connections should be made with No. 14 wire. A support, O, for the shaft, P, is secured to the top of the electro magnet. The shaft, P, has at one end the driving wheel, Q, and at the other end a crank for operating the machine. A one inch belt, R, runs around the pulley, *d*, and the wheel, Q.

When the machine is driven by power the pulley, *d*, may with advantage be larger. The size of the wire on the mag-

FIG. 8

PERSPECTIVE SHOWING HAND CRANK ARRANGEMENT FOR DRIVING ELECTRIC MACHINE.

the commutator ferrule are placed on a line parallel with the core, G′, of the armature; or in other words, it is placed just a quarter turn from its position in the other case. This is owing to the position of the commutator springs, h′ i′, which are vertical instead of horizontal. These springs are bent outward at the base, and each have a binding post. The armature shaft revolves in standards, L M, and the pulley is somewhat larger in diameter than the one before described, and it is grooved to receive a round belt, which is propelled by a two-foot grooved wheel mounted on a separate standard, as shown in Fig. 8.

The armature revolves between two soft cast iron curved pieces, A′ B′, answering to the lower ends of the parts, A B, in the machine first described. These pieces are secured to a brass plate, F′, at the bottom, and are further secured by the plates, E′, which are screwed on opposite ends as supports to the magnets, C′. The space between the parts A′ B′ is three-quarter inch. The plate, E′, as well as the bottom plate, are secured by dowels, c′, and also by screws. There are 12 permanent U magnets, C′, mounted on the pieces, A′ B′, separated by strips, D′ D′, of soft wood, and clamped by the plates, E′, which are drawn together by bolts, a′ b′. The permanent magnets are of the ordinary kind, such as may be purchased at almost any of the toy or hardware stores.

This machine is more easily constructed than the other, but it is not quite so powerful and satisfactory.

Care must be taken to get a good contact between all of the magnets, and the parts, A′ B′, which are in reality a simple elongation of the poles. In either of these machines it is well to varnish the helices with good alcoholic shellac varnish.

With machines like these the writer has been enabled to perform a host of interesting experiments which would probably have remained untried if batteries had been the only source of electricity, as they are exceedingly troublesome, whereas the dynamo-electric machine is always ready.

It is not claimed that it will answer *every* purpose, but it will be found of great value in the laboratory, in the school, and for private use.

ELECTRO-DYNAMIC ILLUSTRATION.

Every one is familiar with the old but very beautiful method of illustrating the direction of the lines of magnetic force around a magnet and between its poles by sprinkling

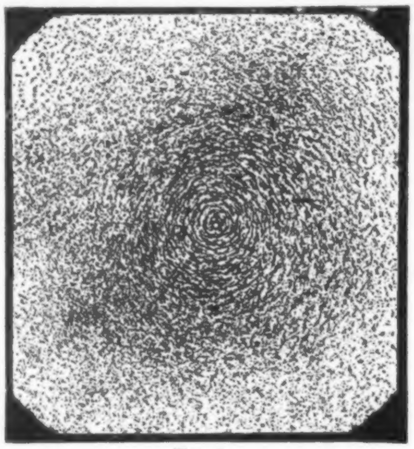


Fig. 1.

upon a card, or other smooth surface, placed above it, iron filings, which, arranging themselves in patterns corresponding to the lines of equi-potential magnetic activity, form a graphic illustration of the forces at work in what is known as a magnetic field. The first person who employed iron filings for this purpose was the celebrated Dr. Gilbert, who records his experiments in his book "De Magnete,"* which was published in the year 1600, and which plays so important a part in the historical literature of electrical and magnetic research. In the year 1756, Musschenbroek made use of filings to form magnetic figures for the purpose of investigating the distribution of magnetism in bars, plates, rings, and other forms, while later on Roget, Playfair, and Leslie employed them in experiments on simple magnets, the former being the first to illustrate by means of the figures so formed the repulsion between similar magnetic poles and the attraction between poles of a different sign.

It was Sir Humphry Davy, however, who discovered that iron filings were attracted by a wire through which a voltaic current was being transmitted, and his great successor, Faraday, obtained some of the forms which we illustrate herewith, and pointed out the importance of this method of investigation.† He also succeeded in forming permanent records of the figures, first by fixing them by means of gum to the card on which they were formed and then pressing them upon a sheet of paper moistened with a solution of potassium ferrocyanide (or what was at that time known as yellow prussiate of potash). Wherever the iron touched the paper so prepared decomposition took place, Prussian blue being formed, and by this means he was able to obtain permanent reproductions of the filing figures printed in Prussian blue upon a white ground. More recently Professor Guthrie made a series of experiments upon magnetic figures, two of which are figured in his book upon "Magnetism and Electricity."‡ In the United States Professor Mayer, of New Jersey, fixed some of the magnetic figures upon glass with a solution of shellac, by which means he was enabled

* "De Magnete, Magneticque Corporibus, et de Magno Magnete Tellure Physiologia Nova." London folio, 1600.

† Faraday's "Experimental Researches," vol. iii.

‡ "Magnetism and Electricity," by Frederick Guthrie, F.R.S., Professor of Physics at the Royal School of Mines. London: William Collins, Sons & Co., page 254.

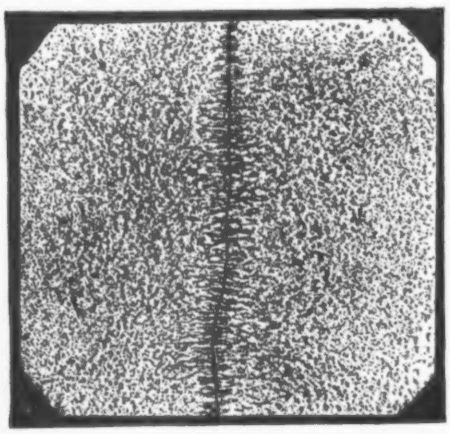


Fig. 2.

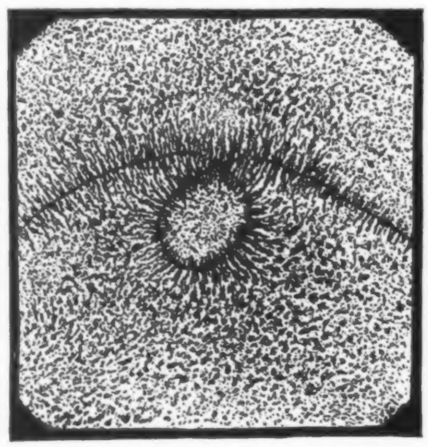


Fig. 3.

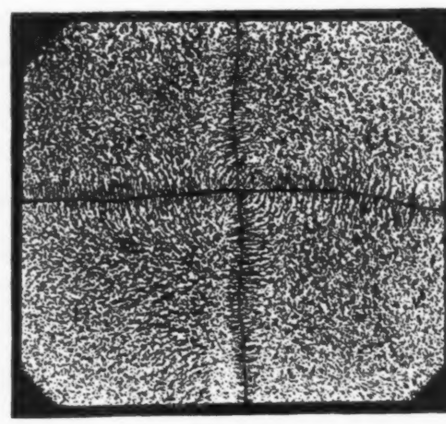


Fig. 4.

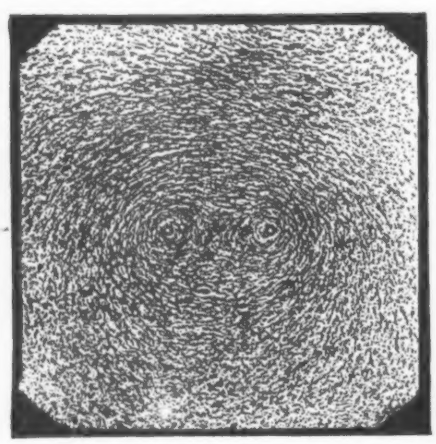


Fig. 5.

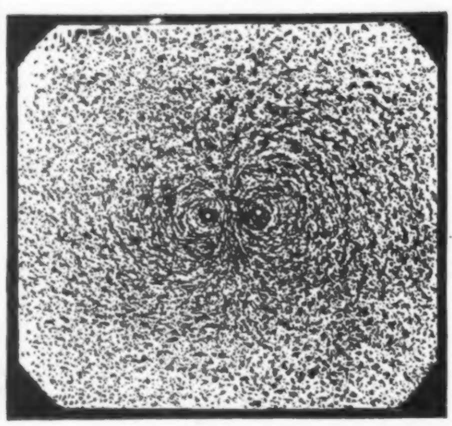


Fig. 6.

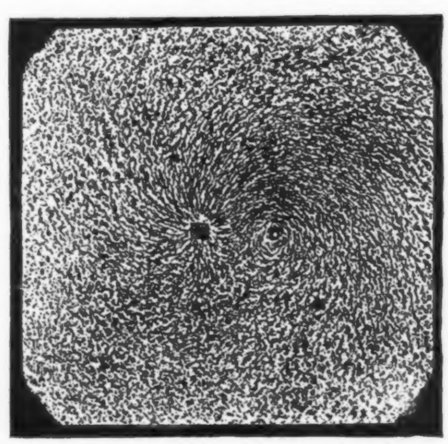


Fig. 7.

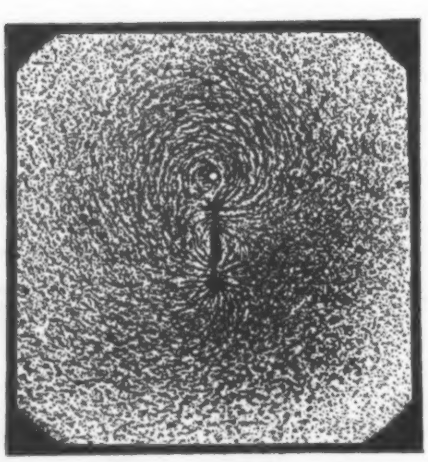


Fig. 8.

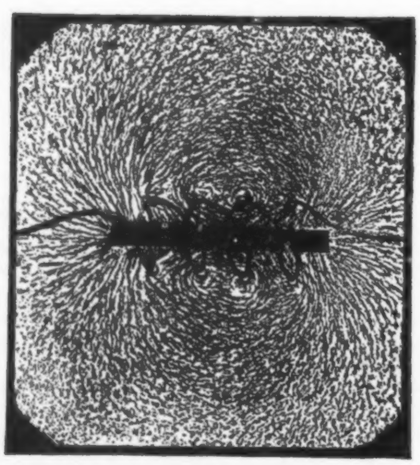


Fig. 9.

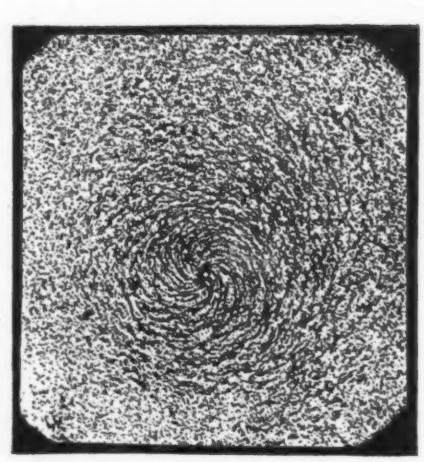


Fig. 10.

ELECTRO-DYNAMIC ILLUSTRATIONS.

to project them upon a screen, and to obtain copies of them by photography.

Taking up the subject where others had left it, Dr. Silvanus P. Thompson, Professor of Experimental Physics in University College, Bristol, has, during the last two years, elaborated this method of magnetic and electro-dynamical investigation to so remarkable a degree that he may be said to have introduced a new branch of electrical research. The subject was first brought by Dr. Thompson before the Physical Society of London in February last, and a second communication was made by him to the same society in the month of June, when some of the figures with which the article is illustrated were projected upon the screen. At the meeting of the British Association which was held at Dublin in August last, Professor Thompson brought the research before Section A, in a paper "On Some New Magnetic Figures," which was illustrated by a very large number of magnetic and electro-dynamic figures fixed upon glass for use in a projection lantern, as well as a number of photographs from them and from others of a similar nature. These figures, some of which we now reproduce, illustrate in a very beautiful manner not only lines of magnetic force and the mutual attraction and repulsion of voltaic currents passing within what may be called "electro-dynamical range" of one another, but also the phenomena of electro-magnetic rotation and the forces at work in the action of such physical instruments as galvanometers (including, of course, all needle telegraph instruments) and magnetometers. Since that time Dr. Thompson has still further elaborated the system so that he is enabled by it to demonstrate and illustrate nearly all the laws of magnetism and electro-dynamics. The method which he adopts is to coat plates of glass about 3½ ins. square with a solution of gum arabic, in which a small proportion of gelatine is dissolved to prevent the film cracking off in flakes; when this is dry a perfectly smooth transparent hard coating is given to the glass plate. The wires or magnets having been placed below, finely sifted filings of wrought iron are dusted over the plate from a muslin bag, the plate being gently tapped with a light glass rod until the figures are formed. A gentle stream of steam from a small boiler is then directed on to the plate by a flexible tube, the effect of which is to soften the gum, into which the filings sink without being displaced, and are found to be firmly adhered to the glass when the plate is dry. A glass cover plate, upon which the positions of wires, poles, magnets, etc., are marked by means of opaque paint or black paper, is then fastened round its edges to the plate carrying the figure, and can then be photographed either as a transparent plate for projection on the screen, or as a negative for printing upon paper.

If the end of a small bar magnet be placed below a card or a plate of glass, a fitting figure formed around it would consist of radiating lines constituting a star, of which the end of the magnet would be the center, and this would be the same whichever pole were presented to the under side of the plate, but if the end of a second magnet be placed against the plate within the magnetic field of the first, that is to say, so that the magnetic fields of both magnets would overlap, the filing figure becomes greatly changed. If the pole of the second magnet be of the same sign as the first, mutual repulsion will ensue; this will be shown by the lines which radiate from the one magnet turning away from as if avoiding those from the other, and the effect will be to form a sort of brush on each side of the line joining the poles, none of the lines from the one pole coalescing with or running across any of those from the other. But if an opposite pole be substituted for that of similar polarity, attraction will take place, which will be illustrated by the running together of the lines of force radiating from both magnets, so as to form between them a bundle of elliptic loops connecting the one pole with the other. If instead of placing the end of a magnet against the glass, whereby lines of magnetic force are formed, a hole be drilled through the plate, and a wire be passed in a direction normal to its surface, through which a strong voltaic current is passing, the lines of force instead of radiating from a center will be found to consist of more or less concentric circles of which the wire is the center; this effect is illustrated in Fig. 1. Were it not for the necessary imperfection of the process by which they are formed these circles would be perfectly circular and perfectly concentric, and the distances between any circle and its nearest neighbor would be proportional to the squares of their distance from the central wire. The circles would, in fact, illustrate a section through a series of equipotential surfaces described about an electrified point in space. Fig. 2 on previous page is formed by sprinkling iron filings upon a plate below which there is a wire conveying an electric current in a direction parallel to the plane of the plate. In this figure the filings arrange themselves in a series of straight lines perpendicular to the direction of the wire and at equal distances from one another, and may be looked upon as a number of repetitions of Fig. 1, strung upon the wire at equal distances apart and looked at edgeways.

Fig. 3 represents the effect of a crossed loop or large "kink" formed in the wire. This figure illustrates very well the mutual attraction of two currents flowing in opposite directions; as well as the corresponding repulsion of currents whose direction is the same, and it also exhibits the electro-magnetic effect within one turn of a helix, through which a voltaic current is passing; in that case the lines of magnetic force would be perpendicular to the plane of the loop, and the filings under their influence could only form themselves (as far as the plate will allow them) into lines perpendicular to the plane of the paper, and therefore seen, for from above they appear simply as isolated dots or points.

Fig. 4 shows the effect of two currents crossing one another at right angles; here again mutual attraction and repulsion are well illustrated, loops being formed in one pair of corners, and brushes in the other pair, showing at the same time a tendency of the two currents to set parallel. These attractions and repulsions are beautifully shown in Figs. 5 and 6, in which the two white dots represent wires passing through the glass plate in a direction perpendicular to its plane, and through which voltaic currents are passing. In Fig. 5 the currents in the two wings are in opposite directions, the one being up, and the other down, while in Fig. 6 both currents are flowing in the same direction. These figures are interesting as illustrating Faraday's conceptions of the physical action of lines of force, which were (1) that lines of force have a tendency to "shorten" themselves; (2) that when lines of force meet one another "end on" they either attract and coalesce, or else they repel and part, according as they are "unlike" or "like;" and (3) that when like lines of force run parallel to one another, they are mutually repelled. The first of these phenomena is well shown in Fig. 5; the annular lines of force around one of the wires have a tendency to run into those surrounding the others, so as to become elliptic curves round the two wires, while in Fig. 6 mutual repulsion takes place, brushes being formed between them.

Fig. 7 represents not only the lines of force radiating from a magnet (shown as a small black square) and the concentric rings formed around a wire, but it illustrates the influence which the one has upon the other when brought into proximity. Here the lines of force show the tendency of an electric current to rotate round the pole of a magnet, and that of a magnet to rotate round a current, the radial lines from the magnet and the circular bands around the wire attracting and coalescing on the one side, and mutually repelling on the other. Fig. 8 is an exceedingly interesting electro-dynamical figure in which the influence of an electric current upon a magnetic needle, free to rotate about its center, is beautifully illustrated. In this figure the forces pulling the needle round may almost be seen at work, and the physical action of the lines of force brought into play in the action of the galvanometer and of similar instruments is well illustrated. Dr. Thompson has still further elaborated this experiment by passing the wire conveying the current over the needle and down through a hole at the opposite end, with greatly increased effect; the displacing lines of force are repeated at the opposite end and on the opposite side of the needle, forming a couple tending to turn the needle about its center.

The experiment of which Fig. 9 is a diagram was designed to illustrate the lines of electro-dynamic and magnetic force brought into play in the induction of magnetism in an iron bar when an electric current is sent through a wire coiled round it. It represents a small electro-magnet showing four turns of its coil. In the actual experiment the bar was a strip of ferrotype iron, and the wire carrying the current was threaded through the eight holes, four being on one side of the bar and four on the other.

One of the most beautiful results of Professor Thompson's experiments is shown in Fig. 10, and illustrates at a glance the phenomena of the rotation of a magnetic pole round itself under the influence of a voltaic current. We have seen that the lines of force around the pole of a magnet are simply radial straight lines forming the figure of a star of which the pole is the center, and that lines around a current are, as shown in Fig. 1, of the nature of concentric circles. If now these two influences be combined, if a current of electricity be sent vertically upward through a magnet, what would be the effect upon the lines of force generated around the point of junction of the magnet and the wire? The filing figure solves the problem very beautifully and exactly in the manner that might be expected. Just as the influence is a combination of the magnet and the current, so are the effects a combination of the radiating lines of the magnet figure with the concentric circles of the current, and a spiral figure is produced, represented in the figure, which is somewhat similar in form to the great spiral nebula in Orion discovered by Lord Rosse. When either the direction of the current or the pole be reversed, a similar spiral* is formed, but the radiating curves turn in the opposite direction; in other words, with one polarity, the spiral is left-handed, and with the opposite polarity the spiral is right-handed. Here, then, is a clear graphical illustration of the phenomenon of electro-magnetic rotation, and to Dr. Thompson belongs the credit of being the first to discover a proof of the fact that even when the magnet is fixed the lines of force are rotated when a current is sent through it.

In these experiments, Dr. Thompson employs wires of silver 0·8 mm. in diameter, using a current from a Grove's battery of either ten or twenty cells. He has produced a very large number of figures, some of which are of the greatest possible interest, illustrating as they do the actions of the various magneto and dynamo-electric machines, as well as electro-magnetic motors and the theories of different physical instruments which depend for their action upon electro-dynamic currents or upon magnetism.—*Engineering.*

* The polar equation to this spiral would be of the form

$$a\,r^2 = w + \frac{2\pi}{n},$$

where r is the radius vector, w the angle from position zero, a a constant depending upon the direction and strength of the current and as the position and strength of the magnet pole, and the successive values of n depend upon the constants of the current and magnet pole also.

THE TELEPHONE ON A VOLCANO.

ITS USE IN DETECTING SUBTERRANEAN SOUNDS.

In an article communicated by Professor de Rossi, of Rome, to the *Bollettino del Volcanismo Italiano* we find an interesting account of some experiments with the microphone and telephone combined, to determine how far these instruments will serve in the science of terreous meteorology, and the result seems to be highly satisfactory. In 1875, and, therefore, some years before Mr. Edison made himself so much talked of, Professor Mocenigo, of Vicenza, published an account of an instrument of his invention containing all the fundamental principles of the microphone; but, as he devoted himself chiefly to perfecting it with a view to its usefulness in his special branch of science, meteorology, the microphone was invented while he was still studying. Professor Rossi at once saw the possible importance of the new invention; and, as in some experiments made at Vicenza the telephone emitted sounds which could only be attributed to subterranean agitations, he determined to make some further experiments himself in an underground observatory of his own at Rocca di Papa, situated on the Alban Hills, on the edge of an extinct volcano. A special microphone, capable of being attached firmly to the rocks so as to feel any motion there might be, was carried down with great care to the observatory, and the professor anxiously sat by it till late into the night, waiting for the hour when all was rested and silent, to catch any sounds that might issue from the telephone. He soon found that the mysterious sounds mentioned to him by his brother professor were not fanciful; and, though uncertain as to their causes, he was soon able to divide them into three classes, which he calls rumblings, musketry reports, and metallic or bell-like sounds. He also discovered that the sounds were periodical at intervals of an hour, or half an hour, or even smaller fractions. He says:

"Wishing to complete my evidence, I determined to carry my microphone to a place where there was no doubt of being on ground vibrating from inner causes—to the side of Vesuvius and the Solfatara of Pozzuoli. Professor Palmieri put at my disposal his observatory. We wished here to establish the connection between the motions of the seismograph and the sounds communicated by the microphone. To ascertain this, one of the assistants of the observatory stood over the seismograph, to mark the motions with signs previously agreed on, to record the agitation preceding a shock, the actual shock itself, and whether the motion was undulatory or perpendicular. At the same time the sounds of the microphone were noted, and found to correspond exactly with the motions of the seismograph; and each different motion corresponded to a different sound. It appeared that the perpendicular motions corresponded to the musketry reports, and the undulatory to the rumblings, while very often there was an uncertain sound, as had been noticed at Rocca di Papa. It appears, too, that the microphone, when placed on ground continually agitated, works with great energy, even when not accurately adjusted, and this became still more evident when taken to the Solfatara of Pozzuoli. Here, indeed, I expected greater results than on Vesuvius, as the area of eruption is more confined and it was more easy to approach the center of activity.

"I was not disappointed, for the microphone, before being adjusted, when artificial vibrations had no effect on it, repeated violently the shocks and rumblings at the bottom of the crater. When the balance had been slightly adjusted the reports became so loud that there was no necessity for holding one's ear to the telephone, and it was quite sufficient to place it on a table for every one present to hear the sounds. Learning that I was about to repeat the experiment, many people came to assist, and all, but chiefly the ladies, could not repress a feeling of fear at hearing the force, rapidity and variety of the sounds, which showed what a terrible furnace we were standing over. The most interesting part to me, however, was that there was no difference, except in intensity, between these sounds and those heard at Vesuvius and Rocca di Papa; and it was hence evident that they all proceeded from volcanic sources. But while our ears were filled with these noises there was no sensible motion experienced, as I had also remarked on Vesuvius, and, except in the two moments of earthquake, at Rocca di Papa. Still it is evident that the microphone, both at Vesuvius and the Solfatara, was registering shocks of earthquake otherwise imperceptible."

This is necessarily only a summary of his paper, and leaves unnoticed many of his experiments and discoveries.—*Rome Letter to Pall Mall Gazette.*

ELECTRICAL CLOCK DIALS.

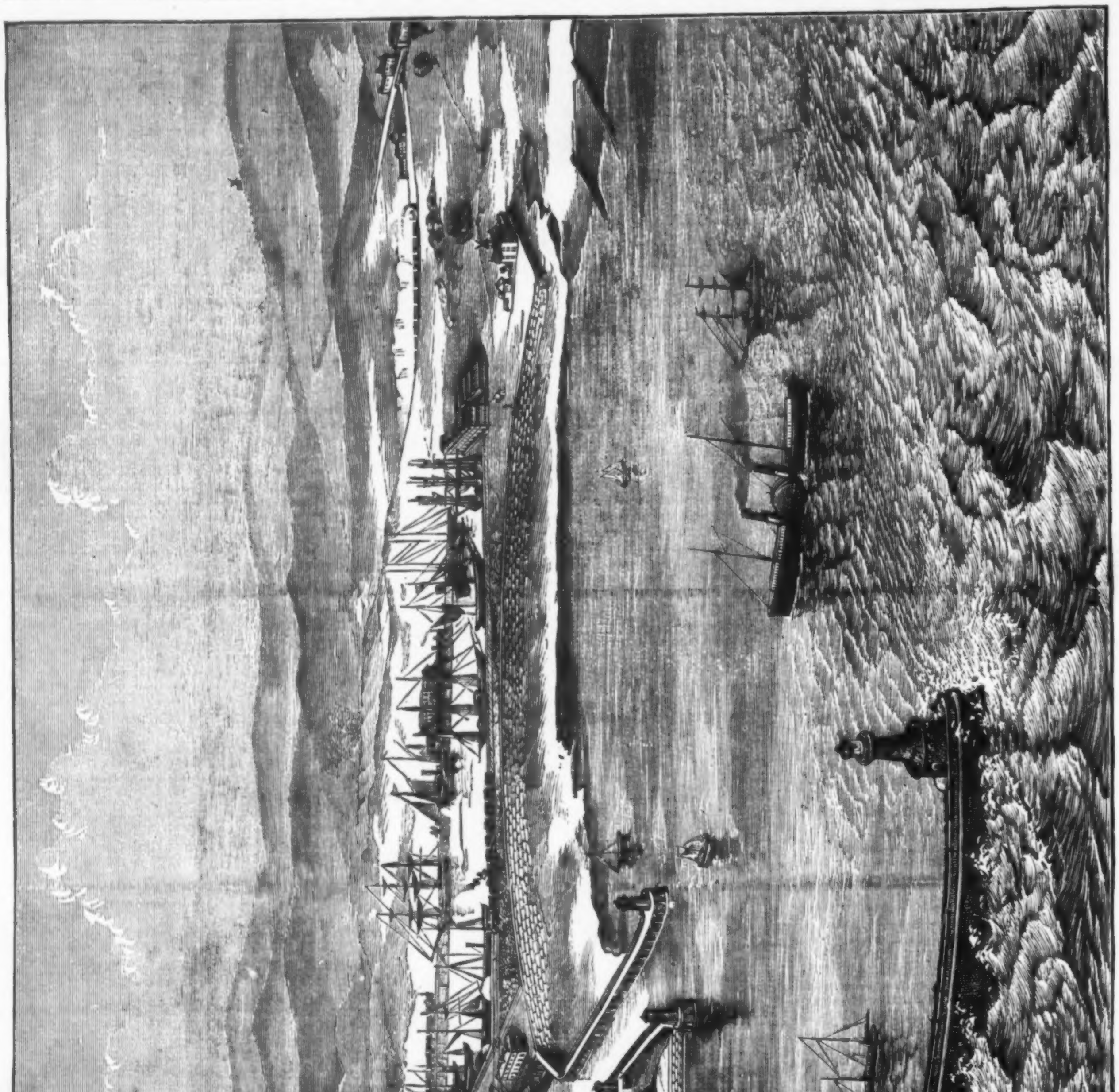
M. RECORDON, of Paris, has since been manufacturing illuminated dials on an entirely different principle from those produced by the use of chemicals. His device is this: A Geissler tube containing a gas which gives a brilliant light is placed on the dial; a battery about the size of a thimble is attached as an ornament to the watch chain, and a miniature induction coil is also hidden in the latter. When it becomes desirable to consult the watch in the dark, a spring is pressed, the current passes into the coil, then into the Geissler tube, and illuminates the dial. The portable battery used for this purpose is that of Trouvé, which, in a small compass, has considerable strength. Reduced to the size of a thimble, it is still sufficiently strong in its action to last a year. M. Recordon also applies the same principle to the illumination of clock faces.

CURIOUS SENSATIONS OF HEAT.

M. HIRN reports some observations connected with the adjustment of the fly-wheel of a steam engine. In driving a large pin one of the assistants rested against its head one end of a cylindrical iron bar about 1 meter (39·37 inches) long and 8 centimeters (3·15 inches) in diameter. Another workman drove the pin by striking upon the free end of the bar. The operation had hardly been begun when the first man stated that at every blow he felt the bar grow very warm and suddenly cool again. M. Hirn, taking his place, found, to his great astonishment, that there was a great change of temperature, which he estimated at about 35° (63° F.). The hammer weighed about 5 kilogrammes (11 lbs.); the workman lifted it about 2 meters (6·56 feet); supposing that the impulse of the arms added a velocity equivalent to a fall of 3 meters (9·84 feet), the increase should have been only 0·13° (0·23° F.), or only about $\frac{1}{270}$ of the observed effect. M. Hirn regards the phenomenon as subjective, and explains it as follows: "In order to observe the phenomenon it was necessary to stand very near the bar, with the head near the path of the hammer, and to seize the iron at about 1 centimeter (⅜ inch) from the end which was struck. This required firm faith in the skill of the workman who was wielding the hammer. I hesitated at first, and seized the bar at some distance from its end; nevertheless, I felt a strong sensation of heat, the source of which seemed to be in the interior of the hand, and not on the surface of the metal. When I became bold enough to take the proper position, the iron seemed to heat and cool rapidly at every blow, the sensation of heat continuing only as long as the sonorous vibrations which were excited in the bar by the blow. The best explanation of these facts, as it seems to me, is to suppose that under certain special circumstances sonorous vibrations, by agitating the sensitive nerves, excite a sensation of heat at the surface of the body analogous to the sensation of light which is produced in the eyes by a blow. This explanation, which I offer with some hesitation, may perhaps be tested by a Melloni thermometer, by observing whether a bar of iron, when struck at one end, really becomes heated during a short interval, so intensely as seemed to be the case in the experiment which I have just related."—*Comptes Rendus.*

DETERMINATION OF ZINC.—C. Mann converts the zinc into chloride and mixes with a few drops of a concentrated solution of iron-ammonia alum, and with an excess of standard silver-nitrate. By titrating back with ammonium sulpho-cyanide till a faint redness is remarked, the excess of silver is ascertained, and consequently the quantity of silver used to precipitate the chlorine, and by reducing the latter to zinc the amount of this metal is known. The zinc is converted into chloride as follows: It is dissolved in nitric acid mixed with ammonic acetate, sulphureted hydrogen gas is passed through the solution, and the precipitate, after boiling and twice decanting, is filtered. The precipitate, along with the filter, is placed in a beaker, mixed with about 50 c.c. of water and an excess of well-washed silver chloride, and boiled till the liquid becomes perfectly clear. The precipitate, a mixture of silver sulphide and excess of silver chloride, is easily washed. When this is complete the filtrate is acidulated with nitric acid, and treated as above.

ROCCELINE SCARLET ON WOOL.—Eleven pounds of wool are boiled for 1½ hours with ½ oz. stannate of soda, and the same weight each of tartaric acid and oxalate of potash. Lift and dye in a fresh water, boiling for one hour with 3¼ ozs. of rocceline, and ⅜ oz. of saffranine of the yellowish cast. Let the wool cool in the liquor, lift and rinse. Darker shades may be obtained in a similar manner by preparing the same quantity of wool with 1¾ oz. oxalate of potash, and ½ oz. alum.—*Farber-Zeitung.*



THE NEWHAVEN HARBOR EXTENSION, ENGLAND.—F. D. BANNISTER, C.E., ENGINEER.

NEWHAVEN HARBOR, ENGLAND.

THE Newhaven Harbor has for many years occupied the attention of those interested in the Franco-English traffic, and the London and Brighton Railway Company have assisted the harbor trustees in their improvement works which have been carried out there during the past twenty years. They have naturally taken a deep interest in all that has been proposed or done for the improvement of the harbor, and negotiations have from time to time been carried on between them and the trustees, with the object of devising some scheme for the purpose, and recently an agreement was entered into, by the terms of which the railway company, for a stipulated annual payment, take into their own hands the duty of dredging the harbor and bar. For this purpose they have obtained a powerful steam dredger, built by Messrs. Symons & Co., of Renfrew, which is now actively at work.

The question of protection to the entrance of the harbor, so as to allow vessels to enter in all states of the weather, and increased accommodation inside, still remains, and a plan has been devised by Mr. F. D. Bannister, M.I.C.E., the engineer to the railway company, to effect these objects, and this plan, in its general features, with the exception of the dock, is almost identical with the recommendations of Mr. Rennie in 1810, and of the Royal Commission of 1844, before alluded to.

The plan comprises (1) a breakwater about 1,000 yards in length, to be run out seaward from the shore at Barrow Head, westward of the harbor, in a direction to protect the entrance of the harbor from the prevalent southwestern and southern gales. (2) The extension of the two entrance piers, and widening the entrance from 150 ft. to 200 ft. (3) The construction of a new wharf or quay between the Mill Creek and the eastern entrance pier, affording additional quay space, about 600 yards in length. It is intended to widen

the harbor opposite this new quay, and deepen it to 12 ft. at low water spring tides. (4) The construction of a dock with entrance lock and gates on the marsh land between the harbor and Catt's Tide Mill, with a water area of twenty-four acres, and quays of about a mile in length. (5) The construction of durable sea walls to protect the foreshore and works, extending from the breakwater on the west to Catt's Mill to the east. (6) Dredging the whole of the existing harbor to a uniform depth of 6 ft. at low water spring tides, and the entrance and new portion of the harbor to a depth of 12 ft.; and also to dredge the space outside protected by the breakwater to a depth varying from 12 ft. to 18 ft. at low water spring tides.

In connection with these improvements, it is intended to provide all necessary wharves, landing stages, tramways, cranes, sheds, and all appliances for carrying on a large trade. Up to a recent period the difficulty and expense of constructing a solid work capable of resisting heavy seas, so as to form a durable breakwater, has been very great, and, except in the case of such large national undertakings as Plymouth, Portland, Holyhead, Dover, etc., has been the main cause of preventing many habor improvements, and the constructions of works of refuge so necessary on our coasts.

Although many methods of construction, and some of great ingenuity, were submitted to the various committees and commissions, the general mode of construction hitherto adopted in large breakwaters has been the system known as *pierre perdue*, the base or foundation being formed by loose stones or rock thrown into the sea and heaped up from the bottom to near low water mark. The bank so formed being allowed to settle down to a natural slope and consolidate, the upper surface is then prepared by divers to receive a superstructure of solid masonry.

This is the mode adopted in the construction of the great breakwaters of Portland, Plymouth, Holyhead, and others, and is necessarily a very costly process, owing to the large quantity of material required to form the base, the necessity of employing divers to place the blocks of stone in position under water to form the superstructure, and the large size of the blocks of stone required to resist the action of the sea.

In more recent times concrete has been largely used in the construction of sea works, and in the form of blocks this material enters largely into the construction of the breakwaters at Dover, Kurrachee, Kustendji, Cherbourg, Madras, and other places, and compares favorably, as to cost, with the old *pierre perdue* system, but the difficulty was still experienced of placing the blocks in position, and of making them sufficiently heavy and compact to resist heavy seas.

It is proposed to construct the breakwater at Newhaven entirely of concrete, and to adopt the system successfully carried out at Aberdeen, where a breakwater or pier has been built in 18 ft. of water at low tides without the aid of divers, Titans, or heavy machinery for placing the blocks, etc., and has stood the heavy storms and seas of the north-east coast for eight years without injury.—*The Engineer.*

INSTITUTION OF CIVIL ENGINEERS, LONDON.

AT a recent meeting, Mr. Abernethy, vice-president, in the chair, a paper was read "On the Heating and Ventilating Apparatus of the Glasgow University," by Mr. Wilson W. Phipson, M. Inst. C. E.

The velocity at which the air should travel at different parts of an apparatus was of great importance, as it fixed the area of the inlets and outlets of the air pa sages. An increased area of the inlet over the outlet of the space to be ventilated was advisable, and the distribution of air into such spaces should be at a mid-level, combined with an upward and downward extraction of the air.

The volume of air evacuated by an extraction shaft depended on its area and on the difference between the internal and external temperature that could be maintained in the shaft, which difference should not be less than from 30° to 40° Fah. Practice proved that an allowance of 5 to 12 square feet of heating surface, at a temperature of 160° Fah., was necessary for every 1,000 cubic feet of space to be warmed, and that the best form of boiler for an extended apparatus was the Cornish type.

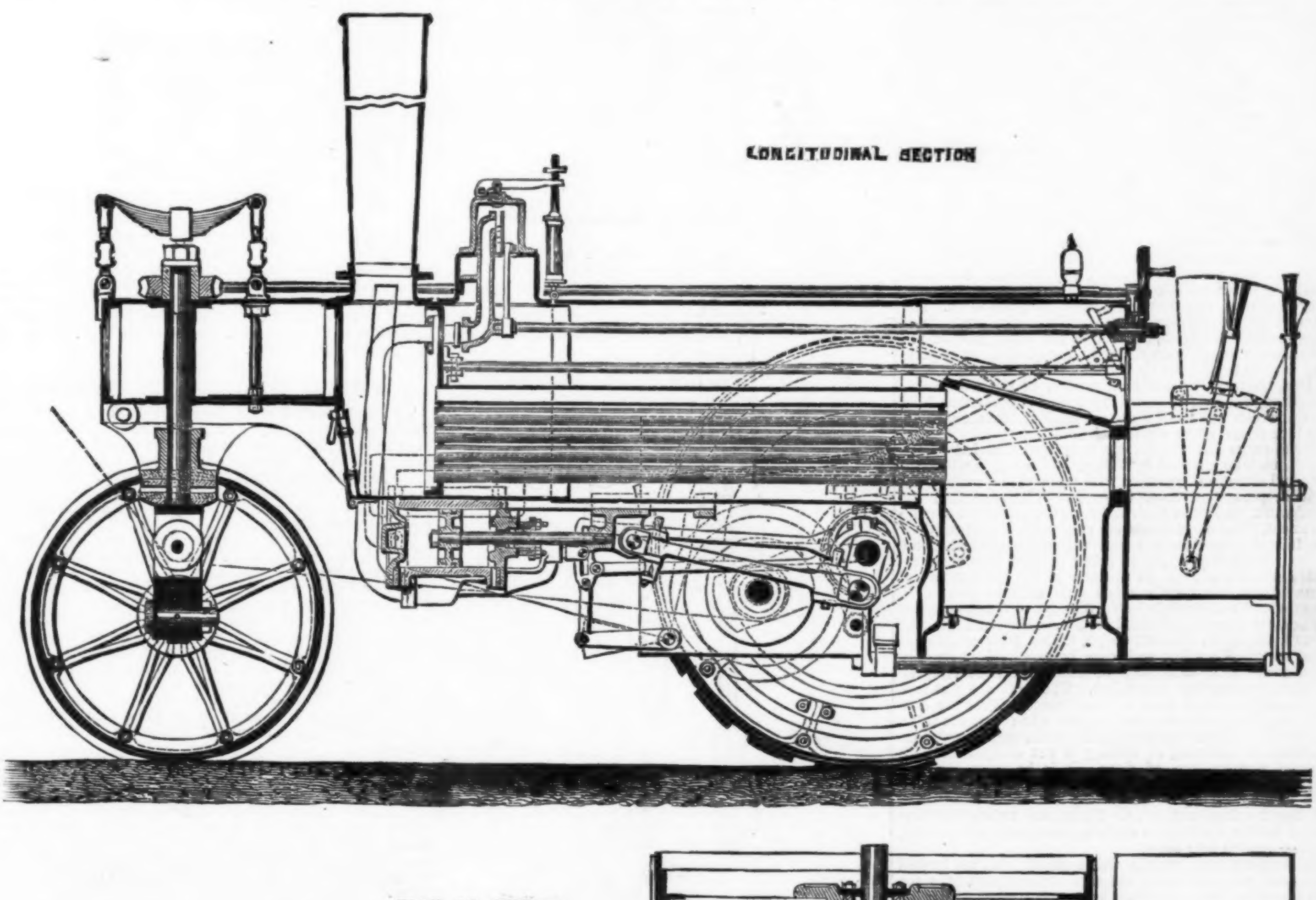
The apparatus consisted of a fan, 7 ft. 6 in. in diameter, having four blades set at an angle of about 60°, fixed on a spindle parallel to the axis of the air channel, and driven by a direct acting 8 horse power steam engine. It drew its supply of air from a height of 100 ft. above the level of the ground, and forced the air through a series of passages into five distinct chambers. In these chambers the fresh air was warmed, previous to its distribution, by being passed over the surface of 4 in. hot water pipes, arranged in coils, each chamber having its distinct hot water boiler. The air then left the chambers and passed to a secondary series of passages in direct communication with the rooms, through vertical shafts formed in the thickness of the walls. The air, after its circulation over the different spaces, was carried away by a third series of shafts formed in the roofs, in communication with the main extractor, situated at the east, southeast, and southwest angles of the building.

The heating surface distributed over the building was about 20,760 square feet. The cubic space to be warmed, including the amount of air necessary for ventilation supplied by the fan, was about 3,800,000 cubic feet, and the average consumption of fuel daily was 2 tons 3 cwt. for a difference of 125° Fah. between the temperature of the pipes and the spaces to be warmed. The volume of air supplied per hour to the building was 1,800,000 cubic feet. The annual cost of maintenance of apparatus was about £500.

EIGHT HORSE POWER TRACTION ENGINE.

WE illustrate below a somewhat novel form of traction engine, invented and patented by Mr. Willsher, of London, and manufactured by Messrs. Fisken & Co., of Leeds.

It will be seen that the engine has a single cylinder placed below the boiler. The driving-wheels are carried on studs or "cannons" secured to the frame just in front of the fire-box. These cannons are filled with brasses arranged somewhat as in the eye of a millstone, and in these brasses the crank shaft revolves. A fly-wheel is fitted on one end of the shaft, which wheel is inclosed within the driving-wheel; to it can be secured a wrought iron pulley, which can be used for driving a thrashing machine, etc. The arrangement of the second motion shaft and internal spur gear is shown by dotted lines. The second motion shaft carries a winding drum, which can be utilized in various ways. The leading end of the engine is carried on springs.—*The Engineer.*



EIGHT-HORSE POWER TRACTION ENGINE.—MESSRS. FISKEN & CO., HUNSLET, LEEDS, ENGINEERS.

A BELGIAN RAG HOUSE.

A CORRESPONDENT of the *Paper Trade Journal* gives the following interesting account of Pfeffer & Co.'s rag works at Ghent, Belgium:

Ghent is about forty miles from Ostend, a seaport town some fifty or sixty miles from Dover. Ghent is termed the "Manchester of the Continent," on account of its extensive linen and cotton factories. Labor is very plentiful, there being 80,000 actual working people out of a gross population of 150,000.

The firm has collectors in every town of any size on the continent, who buy rags, etc., pack them up and send them to Ghent either by rail or water. On arrival at Ghent, the bale is weighed and handed to the sorter. It is, in sorting, subjected to such an ordeal as can only be expressed by the word marvelous.

After sorting, the various qualities of rags are overlooked or checked, cut, then dusted and finally pressed by hydraulic power into bales bound in iron. These bales containing clean cut rags, go away direct to the paper-maker's boiler. Such is the system, and I shall now proceed to show how it is carried out.

The factory building is in three floors, the bottom of which is flush with the yard, and contains the "stock." The stock of uncut rags is kept at a minimum of 2,000 tons, and the cut rags at six hundred to seven hundred tons. In case of any run for orders or deficiency of supply the firm is never troubled. Upon one side of the ground floor are six hydraulic presses which turn out one hundred bales per day. These presses are stationed alongside the delivery bins, tall boxes which are filled from above with the various sortments of rags. Everything is handy, and nothing is wanting. In the corner of the ground floor stands the duster. This is an ordinary duster, fitted with a traveler which takes the dusted rags up to the third floor to be overlooked, before sending to the bin ready for pressing. This duster is driven by a steam engine, which is in a shed quite apart from the rag warehouse. An underground shafting communicates the motive power to the duster and the hydraulic machinery.

Passing innumerable bales of rags, ropes, bagging, waste papers, etc., we come to a small room where iron hoops are being punched and cut for baling. Proceeding through the center of the first floor, which is quite open to admit light and air, we arrive at the staircase and ascend to the third story, where the sorting is going on. The *modus operandi* is as follows: Before a table of wirework are two girls, surrounded by boxes, into which they throw each special brand of rag. Thus a portion of a bale is given out to them. The bale contains all the various rags of the country in which it is collected, and frequently much material that is not fibrous. The girls separate the linens, cottons, colors, new and old, worsted, linseys, paper, and rubbish. Very prominent notices to beware of India rubber are hung in various parts of the workroom. Buttons, metal, leather, wood, etc., are carefully abstracted, while the incessant shifting and moving knocks out a large amount of dust, which falls through the wire table down a shaft, is collected and sold for manure. After the bale has undergone this sorting, the various qualities in the boxes are again sorted. For instance the white rags will be separated into new pieces, first linens, seconds, thirds, dirty rags, discolored rags, torn rags, and so on. The same with colors. Waste papers undergo the same strict process, and I was astonished to find the little girls of ten years old so thoroughly *au fait* with the qualities of papers.

This sorting is all done by piece work. Forewomen, paid by salary, however, parade each section of the workroom, encouraging the girls to work by various expressions in a language which was itself quite a sufficient stimulus, so far as my idea would allow me to judge.

After the rags left the sorters they were handed to the overlookers, who are paid by salary, and are girls whose industry and attention, together with matured experience, obtain them promotion from a sorter. They overhaul the sorters' work, and upon their flat rests the pay of the sorting department. The overlookers are very particular about their work, indeed scrupulously exact, and quite astonished me with their preciseness. After being divided into their respective classes the rags go upstairs to the third story and are cut. Upon this floor are 500 girls, each in front of a table fitted with an upright knife, the edge of which is turned from her. A stone is provided for sharpening, and the girl draws the rag down the knife edge, taking great care to cut out the seam. Very few accidents happen, and never any very serious cases. The way in which the little children used these knives was surprising. The rags are put into baskets and the seams into wooden boxes. Girls are constantly watching both receptacles, and when either is full a truck comes along a tramway and takes the rags away. Perfect silence is observed, as talking is not compatible with the strict performance of duty. It is, however, too hard a task to keep 500 women's tongues quiet, so they are allowed to sing. They do sing, too, and work together as they sing in time and tune. From the knives the rags descend to the duster, are dusted, once more overhauled, and then pressed into bales.

The bagging, rope, canvas, waste papers, etc., are treated in the same way, and under the same strict *régime*. To my mind I could not help thinking too much sorting was being done, but the house insists upon regularity of supply and perfect immutability of material.

There is an extensive yard, and the engine, a 30-horse power Belgian engine, is in one part of the yard, about twenty or thirty feet from the main building wall. Above the engine is a drying room for any rags that may happen to get wet.

The State Railway comes into the yard, and connects Ghent with all the continent; so that rags come direct here from Pfeffer & Co.'s other warehouses at Paris and Antwerp. The canal is also quite adjacent, and affords direct communication with Bruges, where this firm has another large cutting establishment. On my return I visited this place also, and saw the same cutting operation being performed here. The sorting, however, being of the greatest importance, is all done at Ghent.

In addition to a similar establishment at Paris the firm has supplied knives and rags to the following prisons: Paris, Versailles, Ghent, Audenarde, Tournay, Namur, Courtrai, Bruges, and Hoogstraten. Some of the most deserving and well-behaved convicts have been taught to cut the seams away, and are paid a small sum by the governors of the prisons, who have a contract with Pfeffer & Co. to cut the rags at so much per ton. New cuttings alone are cut at these prisons, and an officer of the firm pays periodical visits to each prison to see that the work is being properly and regularly done.

The following statistics are interesting: At Ghent there are 1,200 hands, mostly children, because they do the work as well as, are taught more easily, and are more easily managed than, adults. At Bruges 1,000 hands are employed.

The output at the several places is as follows: Ghent, 250 tons per week; Bruges, 150 tons per week; Paris, 200 tons per month; Belgian prisons, 100 tons per month; French prisons, 50 tons per month—making a total aggregate output of 2,000 tons per month.

In addition to the Ghent stock, 2,000 tons of uncut rags, etc., are always kept in warehouse at Antwerp, almost entirely for the American trade.

The house has a method of insuring its employes, which is very noteworthy. Every person in its employ is insured in the Royal Belge Company, and by payment of a small premium the company agrees to pay the firm the half pay of anybody who, through accident or illness, is absent from work. In case of death, six months' full pay is allowed, and in all cases the firm hands the money to the workpeople, some of whom, in innocent ignorance of the management, accept the sum as the generosity of the firm—a perfectly correct view after all. If the employe leaves them his or her policy drops. A medical officer is appointed, and upon his certificate and monthly returns the insurance company depends.

There are also voluntary money prizes given by the firm every week of 2 fr., 1½ fr., and 1 fr. to the girls who turn out the best work. If there is a lazy girl in the place she is put to work with a very industrious companion, that she may be forced by contagious example to get on as fast as her mate. If this course proves inefficient she receives eight days' notice and is discharged. No strikes are known in the works, and about one-half the entire staff of girls have been here since 1873.

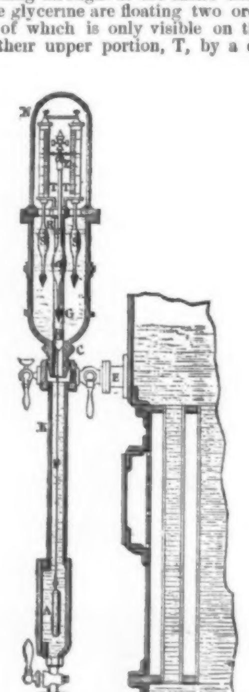
Above the office is the sample room, where are arranged in 158 cases the various material from the work rooms. There are seventy classes of rags, twenty-five classes of bagging and waste, and thirty classes of waste papers. This will give a faint idea of the really terrible scrutiny exercised in separating the various classes of fibers.

The great advantages of this very elaborate system are: Firstly, the certainty of getting a specific class of rags; secondly, the confidence of the paper maker in his raw material; thirdly, the readiness of the rags, etc., for immediate use, cut and clean.

HUCH'S DENSIMETER.

THIS apparatus indicates, both in Baumé and Brix degrees, the exact degree of density of saccharine solutions continuously during the whole operation of evaporating.

It is represented by the accompanying engraving. As will be seen, the instrument is connected with the boiler by two tubes, E E, provided with stop cock. K is a metal tube, filled with the solution; upon it is fastened a reservoir, G, by means of the conical stopper, C. The reservoir is filled with glycerine. In its center is provided a brass tube, R, extending throughout the entire height of the reservoir. In the glycerine are floating two ordinary areometers, *a a* (one of which is only visible on the engraving), connected at their upper portion, T, by a cross-piece. T



HUCH'S SUGAR DENSIMETER.

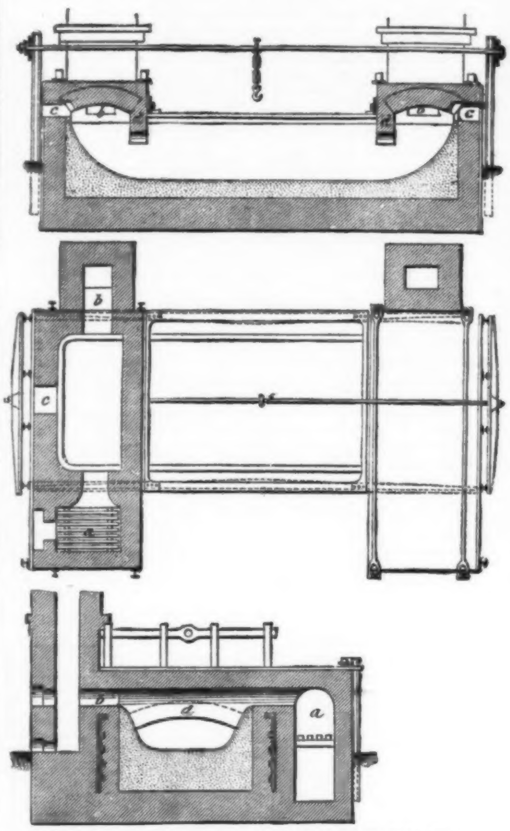
carries the index hands, Z. From the cross-piece is suspended a platinum wire, P, carrying a weight, A, immersed in the solution of sugar. The latter, being continually and automatically renewed in the tube, K, keeps the areometers constantly in a position corresponding exactly to the specific gravity of the solution. In order to compensate the influence of the temperature and variations in the level of the glycerine, the scale is attached to two floating tubes, S S. Before it play the index hands, showing the exact degree of density. The apparatus is covered by a glass bell.—*Dingler's Journal.*

IMPROVED ZINC BATH FOR GALVANIZING IRON.

THE success of the otherwise so simple operation of galvanizing iron depends principally on the quality of the zinc bath. Only in case the molten metal flows easily, the coating will be of the desired uniformity and adhere firmly to the iron. Zinc, however, unfortunately absorbs iron very rapidly. Hereby its melting point is raised and it soon becomes useless. This difficulty is principally due to the fact that the vessels used for the operation are made of cast or wrought iron.

Mr. F. A. Thum has now constructed an improved apparatus, by which this difficulty is said to be entirely overcome. It is illustrated by the accompanying engravings, Fig. 1 being a longitudinal, Fig. 2 a lateral, and Fig. 3 a transverse section.

The metal is contained in a basin built of stone masonry and lined inside with a thick, uniformly glazed layer of fire clay. In Fig. 1, *c c* are openings provided with doors, serving for the introduction of the metal and the removal



THUM'S IMPROVED GALVANIZING BATH.

of the oxide formed on the surface of the latter. The flames come in direct contact with the metal in the space inclosed by the arches, *b b*, supported at one end by stone pillars, *d d*. Figs. 2 and 3 show the position of the furnaces, *a a*, over which small quantities of zinc may be heated separately, to determine the exact degree of heat. The mode of immersion is identical with that of other baths.—*Berg- und Hüttenmännische Zeitung.*

WELDING OF POWDERS BY PRESSURE.

THE transformation of fragments and of powder into homogeneous bodies by strong pressure is of much interest, both from a physical and a geological point of view. M. Spring, of the Belgian Academy, was accordingly led to make experiments regarding it. A recent report he has made to the Academy is of preliminary character, embracing only a few experiments, for an injury to his apparatus interrupted the investigation.

The apparatus he used consisted of a steel prism 0·04 m. square surface of base, and 0·12 m. height, having perforated in its axis a hole of 8 mm. diameter. One end of the hole was closed with a small steel cylinder 1 centimeter long, fixed by means of a strong screw. On this the powder to be compressed was shaken out, and a series of small stampers of the best cast steel were brought down on it, till one of them exceeded the upper opening of the hole. A screw was now fixed on the end, and worked with a screw key 1·5 m. long. Exerting on the end of the key a force of 50 kilos, a pressure of 40,000 atmospheres was obtained on the powder, and if a waste of 50 per cent. be allowed for strong friction, we have still a pressure of 20,000 atmospheres.

First, pure fused nitrate of potash that had been pulverized in porcelain mortar was compressed. The result of the strong pressure was that the fine powder was changed into a firmly adherent block, difficult to get out. The mass was homogeneous and transparent, like porcelain, much harder, more resistant to fracture, and transparent, than a part of the same nitrate obtained through fusion. The density of the mass was 24° = 2·008, while that of the fused nitrate = 1·991

Next nitrate of soda was compressed. In this experiment the steel stamper got welded with the inner wall of the cylinder; it was, however, loosened. The compressed powder of nitrate of soda, which was not pure, but contained some chloride of sodium, formed a very hard mass, resembling porcelain, and solider than the fused nitrate. The density was 2·198 at 24°; that of the fused nitrate is 2·195 Here, then, the compression was less strong.

The experiment was next made with sawdust of poplar wood. In this case, also, a block was obtained that was harder than the wood which furnished it. The structure of the block, however, was not regular. At right angles to the axis of the cylinder, and so to the action of the pressure, the block could be easily broken, whereas this was impossible in the other direction. The texture of the block was then a slaty one; it presented laminæ at right angles to the direction of pressure. The density of the compressed piece was 1·328, while the wood had only a density of 0·389. Thrown into water the piece sank to the bottom, but after a time it swelled and fell asunder. The individual pieces were then, however, heavier than water. In this case, also, the stamper got welded to the cylinder wall.

Lastly, the dry dust of a whetstone was compressed. A mass was got which could not be brought out of the cylinder without breaking asunder; but the block was nearly as hard as the whetstone—one could break it, it was brittle. The same result was obtained with dry chalk powder—one could write, indeed, with the piece of chalk obtained, but it was brittle.

Proceeding on the supposition that the less good result was owing to the air adhering to the particles of dust, M. Spring repeated the experiment with chalk, which he had previously moistened with a minimum quantity of water. The result was that the chalk got so firmly fixed to the cylinder wall that it could not be detached. At the same time the apparatus was injured in such a way as to forbid further prosecution of the experiments.

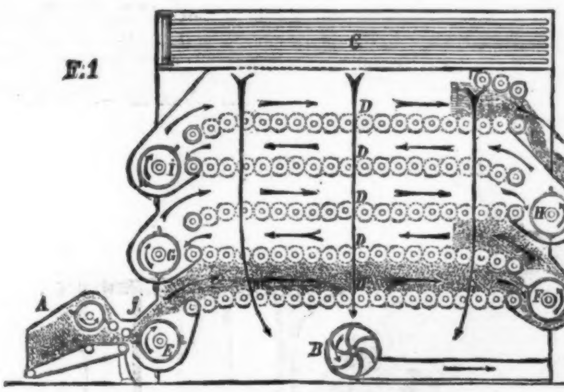
IMPROVED WOOL DRYING MACHINERY.

In constructing an apparatus for drying wool, cotton, and other textile fibers after bleaching and rinsing, three points must be constantly kept in view: In the first place, all danger of discoloring and burning or setting on fire the material must be avoided; in the second place, the space occupied must be limited as much as possible; and lastly, the heat expended in the operation must be completely utilized. The machines ordinarily used are, however, far from coming up to these requirements, and the manufacturer must be satisfied to choose the best from what there is to be had.

Lately, Mr. Bolette, of Pepinsier, France, has built a drying apparatus recommending itself by its safety and economy. In our engraving it is represented as used for ordinary short fleece.

The wool is fed in from the mouth, A, by the cylinder and drums, J and E, and passes successively over drums, F G

F.1



IMPROVED WOOL DRIER.

and H I, between five rows of hollow, perforated cylinders, D, revolving in the direction indicated by the arrows. In the uppermost passage the drum has been replaced by three cylinders. C is a tubular heater, fed from the steam boiler. B is a ventilator, drawing dry air through the passages of the heater into the apparatus. As the sheet of wool passes through the latter it gives up its moisture to the air and is thoroughly dried. The cylinder at one end of each row is lowered a little, so that the opening opposite the drum is completely closed by the wool. Thus the air is prevented from passing through these openings, and is forced to take the course indicated by the long arrows, through the wool and the perforations of the cylinders.

The air enters the machine at a temperature of 122° F., and gives off about eight degrees in traversing each layer of wool. Thus all danger of burning is avoided. By raising the temperature of the air sufficiently, the apparatus may be converted into a carbonizer for vegetable matter.

The different parts are all easily accessible for cleaning and repairs.

The machine is four and a half feet wide, and dries about three hundred pounds of wool per hour.

PROGRESS OF PHOTOGRAPHY IN RUSSIA.*

Six winter months I spent in Russia, and now I intend to communicate to you a few notes regarding my travels. Before, however, I proceed any further, permit me to assure you that I had nothing to do either with Plevna or with the treaty of San Stephano. My notes are purely photographic, and, therefore, I hope I shall not encroach either on British interests or on the rules of this society. It was my good fortune that, although I arrived a perfect stranger in St. Petersburg, I very soon made very valuable acquaintances among persons connected with science and photography; and, thanks to friendly relations that followed our first acquaintance, I have been able to see a great deal, to learn much, and to bring over with me a rich and numerous collection, a part of which is exhibited in this room.

You will not be surprised to hear that photography in Russia is very well represented. In certain branches it occupies a foremost position; and there is sufficient originality to authorize me in stating that there is in the collection before you a great deal that is quite novel and deserving of more than a passing glance.

Most remarkably cultivated is undoubtedly the portraiture, and in this branch very high excellence is attained. Many causes have contributed to this perfection, but most prominent is the artistical culture of the photographers, many of the best known names having attained a high degree of proficiency as painters before they embraced the new art. At the time of my arrival at St. Petersburg there was no photographic society and no special publication devoted to photography; but several gentlemen belonging to various scientific bodies occasionally touched upon photographic problems, and made them objects of special investigation. For want of time it will be impossible for me to enter at present into the details of these investigations. I simply enumerate the names of authors and subjects of study, intending in some other place to give a full account:

W. Lermantoff, professor, attached to the St. Petersburg University, investigated the theory of the formation of the photographic image obtained by development, and explained it by galvanoplastic action. Interesting is the experiment in support of his theory. A small funnel made in parchment is filled with a negative silver bath, and inserted in the ordinary iron developer. Silver wire in the shape of a horseshoe is then inserted in such a manner that one end of it is dipped in silver and the other in iron. After some time crystals of metallic silver are formed on the end dipped in the liquid contained in the funnel.

* A communication to the Photographic Society of Great Britain.

N. Egoroff, professor, of the same university, studied the action of the electrical photometer, based on the principle discovered by E. Becquerel, that if two silver plates covered with iodide of silver be dipped in a weak solution of sulphuric acid—one kept in the dark and the other exposed to a beam of light—the galvanic current will be formed, the intensity of which is proportionate to the intensity of light.

E. Kotelnikoff explained the theory of the formation of the photographic image (negative) by phosphorescence, asserting that iodide of silver by a short action of light in the camera became phosphorescent with ultra violet light, and this light ultimately produced precipitation of silver in the mixture of silver and iron salts when the developer is applied.

H. Wild introduced in the Physical Observatory in St. Petersburg quite an original instrument, named "uranophotometer," to determine daily the intensity of the diffused light of the sky, based on the theory of polarization.

I have in my possession the publications mentioned, and anybody wishing to make nearer acquaintance with them is quite welcome.

During my stay in Russia I had the pleasure of witnessing the organization of a new photographic society. Existing laws of the country put many difficulties in the way of the formation of any society; but, fortunately, in Russia there exists at present a very influential and powerful institution, named the "Imperial Technical Society." I shall not be very far off from the truth if I compare it to the Society of Arts combined with the Kensington Museum. This society, through its enlightened and highly esteemed president, P. Kotchoubey, and secretary, T. Lwoff, offered to the new applicants to accept them as a section of the Technical Society. This arrangement obtained high sanction, and the new Photographic Society is at present on the way to probable success. The president elected is Lieutenant-General Birkin; vice-president, General Tchagin; secretary, W. Sreznewski; committee, Lewitzki, Denier, Klassen, Lapteff, Shpakowsky, Lorens. It was not decided whether the new society would issue a journal, but Professor Wagner, a distinguished editor of a magazine, *Swet* (Light), recently issued monthly supplements under the title *Swetopis* (Photography), the first numbers of which I now forward to the library of this society.

Since January last appeared also a new semi-weekly magazine, *Obzor Graphitzeskich Iskustw* (Review of the Graphical Arts), giving considerable room to photography, and even adorned with specimens of this art.

Photography is largely adopted by many government establishments for the reproduction of maps and of state papers. Perhaps the largest institution of this kind in the world is the well-appointed photographic establishment under the direction of G. Scamoni, who is so well known in the photographic world. Every branch of photography is worked successfully in this establishment, as you can observe by the specimens kindly given to me by Mr. Scamoni and exhibited on the screens. But most original and characteristic are those *heliogravures* produced by the process described in his book, and presenting the same excellence as the world-famed *heliogravures* published by Goupil et Cie. in Paris. Mr. Scamoni's assistant, Mr. Chesterman, is an Englishman. I cannot leave the establishment without taking note of how closely allied with photography is the art of galvanoplasty. In this establishment iron is electro-deposited to any thickness, and by this means letterpress blocks are produced that are able to give millions of impressions without being worn out—a requisite for the impression of rouble notes so largely circulated in the country. I exhibit a fine specimen of an electro-deposited iron plate presented to me by Mr. Scamoni. By the same process old armor, of which excellent specimens are now being exhibited in Paris, are reproduced quite equal to the original.

Another very important government photographic establishment is in the Depôt of the General Staff, under the able and enlightened direction of Mr. Laptef, chief of the Depôt of Maps. General Shtupendorff is himself an accomplished photographer also, and this contributes to the general success of this very busy and well-organized institution. Photolithography is his principal business. This huge map of the Austro-Prusso-Russian frontier, published for the present war, is certainly a very remarkable specimen of photolithography. However, the most remarkable production of Mr. Laptef is illustrated by this incomparable map, printed from a copper plate, and produced by electro-deposition on gelatin relief. Numerous specimens, not only of prints, but also of negatives used in this establishment, will enable you to estimate fully the excellence and importance of the establishment.

Photography is called in aid by two profusely-illustrated periodicals in the shape of photozincography, which is used for the reproduction of woodcuts published in other countries (copyright in Russia has no effect), but those are generally very inferior.

Among the private establishments that print from gelatine (Albertype) the most remarkable is that of W. Reinhardt's. Among numerous specimens done by this gentleman I point your special attention to this rare manuscript, produced by the joint labor of himself and Mr. Sreznewsky, who, being an amateur photographer and a learned searcher after vestiges of old civilization in his country, took all the negatives from this unique manuscript, whilst Mr. Reinhardt printed them by photolithography, producing, according to his system, the transfers by Albertype. Here are autographs of Peter the Great and Catharine II., and the first book in the Slavonic language, printed in Cracow.

I have not many specimens of portraits in my collection. These you have often opportunity to see at our own and other exhibitions; but I wish to point your special attention to the production of Mr. Denier. This gentleman employs quite an original system of his own. His work, as you can judge by these specimens, is recognized among all others by its extreme delicacy, comparable to ivory or opal. Strictly, no retouching, either on the negative or on the prints, is introduced. His studio is remarkable for noble proportions, and by the total absence of blinds or curtains. He uses collodion especially prepared by himself, and gives very short exposures.

Mr. Lewitzky, whose universal reputation was established long ago in Paris and St. Petersburg, is not sleeping on his laurels. In his studio special attention is paid to every novelty that appears in photography, and you can find there that every new appliance and every process is investigated. He is the only licensee of Lambert and the Autotype Company in Russia, and his productions are worthy of close examination. I only regret that they are not more numerous.

Many other remarkable portrait photographers are well known in St. Petersburg, such as Lorens, Bergamasco (the last most successful commercially), and others; but it happens that my collection is lacking in their works.

Next we approach the very numerous studies of Russian life in endless variety. Only attentive perusal of this very extensive series will initiate the inquiring examiner in the outside appearance and general character of the country and its people. The author of this marvelously well-executed collection is an Englishman, Mr. Carrick, who, when presenting to me this magnificent gift, imposed only one obligation—that whenever I showed any one the result of his labor and artistic genius I must couple with his the name of the late Mr. MacGregor, who was his assistant, and became his instructor and best friend till his lamented death, which occurred several years ago. Almost every photograph is a picture of great artistic value.

The fine views of St. Petersburg and Peterhoff are the work of Mr. Felish, who makes street views his specialty, and, by systematic work, has attained the excellence you can here admire without being tired by their great number. The interior of the prison acquired special interest in consequence of the last attempt on the life of the governor, Trepoff. The unsurpassed series of the interiors of the imperial palaces is the work of Mr. Classen. This is undoubtedly the finest result ever produced; but the reason of this excellence is not difficult to understand, since he possesses artistic and technical qualifications coupled with real love of the art, and extensive practice. Mr. Classen, like Mr. Denier, does not use the blinds or curtains in his studio. The extraordinary panorama of St. Petersburg is also his work.

The next series is the work of Mr. Karelin. You have heard a great deal of discussion respecting these pictures from the time of the last Edinburgh exhibition. I was so struck by them that, without necessity, I went to Nizhnee Novgorod to pay a visit to this gentleman. The trouble of the long journey was repaid by the cordial reception I received in Mr. Karelin's house, and by the pleasure of seeing a large number of far more important works than these. Unfortunately, some very fine specimens have not yet arrived. Mr. Karelin has discovered means to introduce an alteration in portrait lenses which enables him to obtain extraordinary depth of focus without any loss of rapidity. This you can especially observe in the groups I point out to you. But what strikes every observer is that a great many of these photographs are illuminated by direct sunlight, and notwithstanding this they are models of softness. These groups are taken inside the room. I recollect all the fixtures of this rather low and not very light room. I mention this peculiarity for the information of some persons who suppose that these are combination prints. I have also examined the negatives.

Mr. Boldyreff, whose photographs hang on this side, says that he hit upon the same idea as Mr. Karelin. Certainly, some of his pictures approach in beauty those of Mr. Karelin. Quite recently, also, I received information from a friend in St. Petersburg who has also done the same.

It is possible that we shall soon be obliged to alter our photographic outfit for landscape work, and only be satisfied with instantaneous work. This apparatus is the work of an amateur professor in Moscow, Uzutzewsky. It contains a dozen sensitive plates, which are exposed without the aid of a dark slide. It also reminds one of Jonte's camera, but it is much simpler and has other advantages. The same gentleman has invented a very clever portable stand for the camera, which I hope to be able to show on some other occasion.

The indefatigable secretary of the new society, Mr. Sreznewsky, has also constructed a very ingenious box tent.

I introduce next to you a very good apparatus, made in Moscow, to verify the correctness of the position of ground glass in the camera.

Among *matériel* useful in photography I can only show you at present, in consequence of the shortness of time, this cotton, which is very suitable for making pyroxyline. It is prepared as a substitute for lint, and was used in the late war. Its peculiar property is its permeability by water—a quality very desirable in the manufacture of pyroxyline. The process employed to obtain this quality is not well known, but I heard from a good authority that it is the treatment of the cotton by steam at a very high temperature and under heavy pressure.

I close my notes by publicly expressing my gratitude to those gentlemen who, by their generosity, have enabled me to-night to illustrate my paper by these numerous collections.

LEON WARNERKE.

VARIABILITY OF THE SUN'S SURFACE.

At one of the sessions of the French Association, Janssen described the apparatus which enabled him to take photographs with an exposure of $\frac{1}{6000}$ of a second, and explained the new information which such photographs have furnished respecting the upper surface of the photosphere. The polar regions are covered with a general granulation of forms, dimensions and distribution very different from the ideas which have been derived from optical examination. Resemblances to willow leaves, rice grains, etc., may be occasionally traced in single points, but the prevailing and fundamental form is spherical, and the "grains" appear to be clouds of dust or mist floating in a gaseous medium. The luminous intensity of the sun resides chiefly in a few points, so that if the whole surface was as bright as the most brilliant portions its luminosity would be increased from ten to twenty-fold.—*La Nature.*

AN IMPROVED SAPONIFIER.

THE manufacture of glycerine and the fatty acids is based upon the decomposition of fats and the isolation of their several constituents—stearic, margarinic and oleic acids, and glycerine. For this purpose several processes are employed: (1) saponification by lime and subsequent decomposition of the lime soap by sulphuric acid; (2) decomposition by overheated steam at high pressure; and (3) acidification or sulphuric acid saponification and subsequent distillation.

The first-named process is generally admitted to furnish the best results qualitatively. It is generally carried on in open vessels, and is slow and hence expensive. Besides, it is only applicable to good qualities of fat. The second, or simple steam process, is also quite costly. The treatment by sulphuric acid mostly furnishes products of inferior quality; the solid fatty acids have a very low melting point, which injures their value as a material for candles, the oleic acid often holds undecomposed fats in solution, and is then less esteemed for soap manufacture, while the glycerine is generally impure.

One great objection applies, however, to all three processes: the fat is rarely, if ever, completely decomposed, owing to defective contrivances for agitating the mass during the process. A good apparatus, overcoming this difficulty and adapted to all qualities of fat, has therefore long been a desideratum. Recently Mr. Léon Droux, of Paris, conceived the idea of combining the lime process with the second, or steam treatment, carrying it on in closed vessels at high pressure and keeping the mass in constant motion by an improved agitator. After some experiments, he succeeded in constructing an apparatus, which is said to give entire satisfaction, both in quality of goods and point of expense. We copy an illustration of the same from *Revue Industrielle*.

At ordinary temperature, fatty acids have no injurious effects on metals; at a higher degree of heat, and especially under pressure, they act as powerful oxidizers on the majority of metals. Iron vessels would be rapidly worn out. To determine the comparative durability of metals in this direction, Mr. Droux made a series of experiments. He subjected pieces of the different metals, of known weight, to the action of fatty acids at a high temperature and a pressure of 50 or 60 lbs. to the square inch. At the end of one month the pieces were taken out, freed from the metallic soaps and oxides formed, and weighed, when it was found that the following quantities had been consumed by corrosion:

Of Red copper	0·2	per cent.
" Yellow "	0·1	"
" Bronze	0·3	"
" Brass, soft	4·8	"
" Tin	6·0	"
" Steel	6·0	"
" Lead	6·0	"
" Iron	84·0	"
" Zinc	100·0	"

Therefore, Mr. Droux constructed his apparatus entirely of copper and bronze.

Hitherto, the saponifiers had generally been of cylindrical form. Mr. Droux decided to make his apparatus of spherical shape. The sphere, among all bodies, incloses the greatest possible space within the smallest possible surface, and hence the loss of heat by radiation is reduced to a minimum.

As is seen from the engraving, the apparatus consists principally of a large, spherical copper receptacle, the saponifier, made from stout plates, riveted firmly together. It is tested to 100 lbs. of pressure to the square inch, but only registered to seventy-five.

The upper part of the saponifier is formed by the manhole, to the cover of which are attached three stopcocks, one for filling the apparatus, one for exhausting the air, and a third one connecting with the manometer.

Steam is introduced into the apparatus at the base through a pipe, ending in the interior into a semispherical distributer, provided with numerous openings, through which the steam penetrates into the fat. Parallel with the steam pipe runs another pipe for withdrawing the mass at the end of the operation. Both pipes are supplied with stopcocks. Another stopcock is provided near the central portion of the saponifier, permitting taking samples.

The agitator is in form similar to a ship's screw. A stout copper shaft, carrying several copper blades of helical form, revolves in journals formed by plates riveted to the walls of the apparatus. The exterior extremity of the shaft rests on a cast-iron support, and is provided with a pulley to which the steam power is transmitted.

The apparatus may be filled by a pump, but generally the tanks containing the liquefied fat are placed at some height above the saponifier, so that the fat may readily be run into the latter.

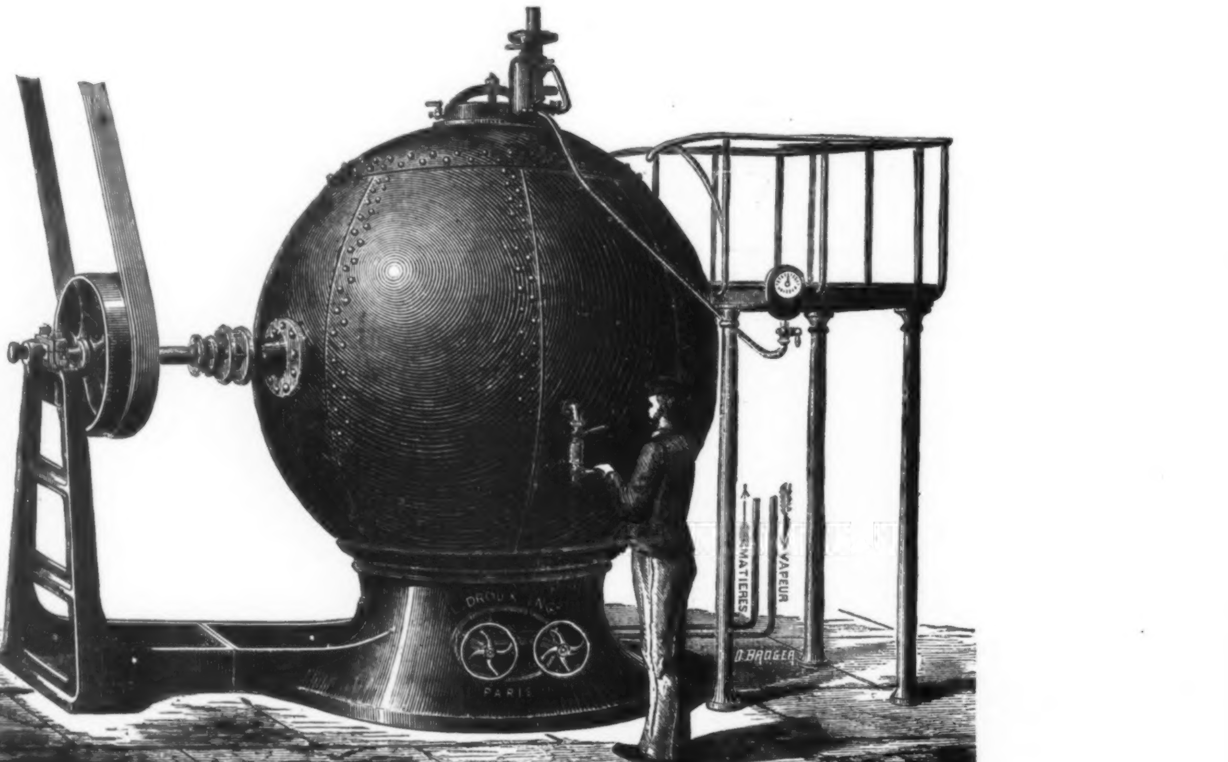
By using this apparatus, the quantity of lime, and consequently that of sulphuric acid, may be reduced about 75 per cent., compared with similar machines of the old styles.

Two or three pounds of slaked lime, mixed with enough water to form a thin liquid, are required for each 100 lbs. of fat. The operation lasts six or seven hours, the pressure being kept during that time at from 50 to 65 pounds per square inch. Little attendance is required besides the proper regulation of pressure according to the quality of the fat treated. Ten pounds of coal are consumed for every 100 pounds of fat.

When the operation is finished, the stopcock of the steam-pipe is closed and that of the evacuation pipe opened, when the mass runs into a tank, in which the glycerine liquor gathers at the bottom, and the lime soap floats on the surface. The liquor is drawn off to the filters and concentrators, while the lime soap is transferred to a leaden vessel, where it is decomposed by the action of dilute sulphuric acid, fatty acids and sulphate of lime being formed.

One hundred pounds of fat of medium quality generally furnish 93 lbs. of fatty acid and 10 lbs. of glycerine liquor. The apparent surplus of 3 lbs. is formed by water contained in the liquor. The 93 lbs. of acid consists of about equal parts of stearic and oleic acid.

Mr. Droux constructs similar apparatus, without agitator, for refiners of olive and other fat oils.



DROUX'S IMPROVED SAPONIFIER.

CHEMICAL NOTES

QUANTITATIVE DETERMINATION OF SULPHUR.—O. Fahlberg and M. W. Iles.—If sulphur is fused with a sufficient excess of alkali it is converted entirely into sulphite, and not into a mixture of hyposulphite and sulphide, and if still more alkali is present the result is a mixture of sulphite and sulphate. To oxidize the sulphite to sulphate the authors apply bromine. They have successfully applied this analytical principle to organic sulphur compounds, to free sulphur, and metallic sulphides. The fusion of sulphur or a metallic sulphide with potassa yields a sulphite without any loss, which is then oxidized by means of bromine and hydrochloric acid, forming sulphuric acid, which is then determined in the ordinary manner. Where metallic oxides are separated after the fusion in an insoluble state, they are removed by filtration before the bromine and hydrochloric acid are added. Sulphides of arsenic, antimony, zinc, etc., all yield, after melting, a fusible mass, while in case of sulphides of iron and copper these metals are left behind in the state of oxides. Even in pyritic silicates the sulphur can be accurately determined in this manner. Care must be taken that not less than 25 grms. pure caustic potassa is taken to every 0·1 grm. of sulphur supposed to be present. The operation is performed in a silver crucible, and the fusion is continued till the mixture becomes tranquil—say from fifteen to twenty minutes—or till vapors of alkali begin to condense along the upper part of the crucible, which after use shows a clean surface if sufficient alkali has been used. When cold the mass is dissolved in cold water, freed from oxides, etc., by filtration, mixed with from 75 to 100 c.c. bromine water and hydrochloric acid, added till a distinctly acid reaction is obtained. Heat is then applied till the liquid is colorless.

OXIDATION BY MEANS OF PERMANGANATE OF POTASSA.—S. Hoogewerff and W. A. Van Dorp.—Aniline yields oxalic acid, almost a fourth of its carbon being oxidized. Azobenzol is also produced. Ortho-toluidin treated in the same manner yields also oxalic acid and azo-toluol, a beautiful red compound which crystallizes from ether in well-formed prisms, and melts at 55°. About 50 per cent. of the nitrogen present in the ortho-toluidin reappears as ammonia. In para-toluidin only about 40 per cent. of the nitrogen is obtained as ammonia. Para-azo-toluol was also obtained as a body insoluble in the oxidizing liquid. The yield of oxalic acid is relatively smaller than in the former cases.

DECOMPOSITION BY SUPERHEATING.—A. Letny.—The author claims priority as against Liebermann, Burg, Salzmann, and Wickelhaus. He passed residues from Baku petroleum (sp. gr. 0·87; boiling-point 270°) through an ignited horizontal retort, 7 feet in length by 1 foot in diameter, and filled with wood-charcoal. The products submitted to dry distillation began to boil at 80°, yielding up to 90° benzol (4·6 per cent.); up to 145° toluol and its homologues (5·2 per cent.); up to 340° naphthalin and unchanged petroleum (35·5 per cent.). The portion boiling above 340° was received in three parts; *a*, phenanthren 2·7 and petroleum 9·3 per cent.; *b*, anthracen 2·4 and petroleum 5·2 per cent.; *c*, anthracen 1·94 and petroleum 6·04 per cent. Besides petroleum and lignite tar the products of the dry distillation of natural asphalt, of resinous shales, and the last residues from the refining of petroleum can be decomposed into aromatic hydrocarbons.

AMBER VARNISH.—S. Meredith prepares a varnish which gives a very fine polish, and which is especially valuable for carriages and for choice furniture. He puts 7 pounds of amber in a clay crucible, with 14 pounds of rock salt, adding water enough to dissolve the salt. He then adds more water, and keeps the crucible over a fire until the amber becomes perfectly white. The bleached amber is put into an iron pot, and warmed over an ordinary fire until it is completely dissolved; the pot is then allowed to cool, and the amber is placed in a stream of water, to remove the salt; it is then reheated until it dissolves, when it is poured on a marble table to evaporate the water, and then exposed to a greater heat to drive off all moisture. This bleached amber is powdered, and then melted in an iron pot. Fine nut oil is added, and stirred until the mixture is complete. The pot is then removed from the fire, and, when sufficiently cool, spirits of turpentine is added to produce the proper consistency. The following proportions are recommended: White amber, 1 lb.; fine nut oil, 1 lb.; spirits of turpentine, 2 lbs.—*Les Mondes.*

PHONIC WHEEL.—P. Lacour has devised a toothed wheel of soft iron, which turns on its axis so that its teeth pass near one pole of an electro-magnet without touching it. An intermitting electric current, regulated by the vibrations of a reed or tuning-fork, traverses the coils of the magnet, so that it periodically attracts the nearest tooth. The wheel, turning with such velocity as to traverse the space between two teeth at each period of the current, maintains a uniform movement. It is well-fitted for use as a chronograph, for finding the number of vibrations in a given musical note, and for establishing synchronism in telegraphy.—*Comptes Rendus.*

NEW METHOD OF DETERMINING MELTING POINTS.—Carnelly places the substance (especially metallic salts) in a weighed platinum crucible, heats it over a Bunsen burner or blast, and as soon as the salt melts places the crucible in water, the weight and temperature of which are known. The increase of temperature in the water is observed, and by the aid of the equation for the specific heats the temperature of the crucible is found as the salt began to melt.—*Zeitschrift Anal. Chemie.*

BALDNESS AND ITS TREATMENT.

IN the Atlanta *Medical and Surgical Journal*, Dr. George H. Robe writes on this widely interesting subject:

Having been himself a sufferer from seborrhea and consequent alopecia for six or seven years, the writer has, as may be supposed, tried a great many remedies with a view to its alleviation and cure. Arsenic, internally, stimulating washes or oily applications, containing in the one case corrosive sublimate, in the other quinine or tannin, in still another some of the stimulating oils, were used with no appreciable effect either on the formation of scales or the depilation. Finally, about two years ago, an item went the rounds of the medical journals to the effect that a French physician, whose name has escaped me, had found that the local use of a five per cent. solution of chloral hydrate was a sovereign remedy for the trouble under consideration. Rejoiced that at last I could appropriately shout "Eureka!" I began to use the chloral wash assiduously for about three months, following the directions given as accurately as possible. At the end of the three months the production of scales was more rapid and the fall of hair greater than ever. Disgusted with the failure of all the therapeutic measures which had been so highly lauded, I almost decided to let the affection take its own course, and run the risk of a shiny bald pate at thirty. About that time the second volume of Hebra's classical treatise on diseases of the skin came to hand, and one of the first things I read was Kaposi's thorough article on alopecia. Impressed with the reasonableness of the views put forth by Kaposi, I determined to give his plan of treatment a trial, with the result of checking the fall of hair and diminishing the production of scales in a reasonably short space of time. I have since then recommended the plan in a considerable number of instances, and when it has been faithfully carried out, with uniform success.

The success of the method depends upon the use of an agent which, while mildly stimulant, removes the scales and thoroughly cleanses the scalp. This agent is the German or French soft soap (green soap, schmierseife, savon vert) in alcoholic solution. This soap is now imported in large quantities and prescribed daily by the dermatologists of Boston, New York, Baltimore, Philadelphia, and other cities. The soap, containing an excess of alkali, saponifies the fatty matter of the sebaceous secretion, and it is thus easily removed. The alcohol greatly assists this action, and seems also to have an alterative action—if such an indefinite term is excusable—on the glands. The two may be combined as follows:

℞. Saponis viridis (Germ.); alcoholis, āā, ℥ ij; solve, filtra, et adde ol. lavandulæ gtt. xx.-xxx.

The oil of lavender is added to cover the disagreeable fishy odor of the soap. The above makes a very handsome orange or wine colored preparation, with a pleasant odor, to which the most fastidious will hardly object.

This is used as a shampoo every morning or evening, pouring one or two tablespoonfuls on the head. Upon the addition of water, and smart friction with the fingers, a copious lather is soon produced. After keeping up the shampooing process for four or five minutes, all the soap must be washed out of the hair by the free use of warm or cold water, and the hair thoroughly dried by means of gentle friction with a soft towel. The immediate effect experienced is a disagreeable feeling of tension of the scalp, as if it were stretched too tightly over the skull. To obviate this effect, and to keep the scalp from getting too dry, and thus, perhaps, set up a true pityriasis, it is necessary to follow up the shampooing with some fatty application, which may contain some mild stimulant, thus: Castor oil, 1 part, to alcohol 3 or 4 parts, with a little oil of rosemary or cinnamon, or the elegant pomades and oils of Bazin and other manufacturers may be used. But the best as well as the neatest preparation that I have employed for this purpose is the hydrocarbon known in commerce as cosmoline. This is a product obtained from petroleum. It is entirely bland and unirritating; never turns rancid, and is comparatively cheap. It may be obtained in the fluid form or as a soft solid.

This procedure, shampooing, drying the hair, and applying the greasy preparation, must be repeated daily for three or four weeks. In the course of that time it will be discovered that the production of scales and the falling of the hair have been very markedly decreased. It will then suffice to repeat it two or three times a week for a month or two longer, after which a good shampoo once a week will usually succeed in maintaining a permanent cure.

Most patients will be alarmed after using this method at first, because the hair comes out in greater quantity than before. This is due to the fact that a large number of hairs are dead and only retained in their follicles by the plugging of the sheath with the accumulated sebaceous matter. The patient should, therefore, always be prepared for the result, and the cause of the increased falling of the hair explained to him.

It is not necessary, though more convenient, to cut the hair short during the treatment.

When the alopecia has lasted so long that the hair bulbs have become atrophied, nothing will restore the hair on those spots. Our endeavors must be directed to saving what remains. A prognosis favorable to the restoration of the hair must, therefore, be given with caution.

EXPERIMENTAL PHYSIOLOGY.

By ROBERT MEADE SMITH, M.D.,

Demonstrator of Experimental Physiology in the University of Pennsylvania.

THE course which we commence to-day will be devoted, not only to the demonstration of the more important of the physiological facts which are due to experimental inquiry, but to your instruction in the *technique* of our subject—the management of apparatus and of animals, the method of performing the various operations, and, in fact, all those details which are so essential to successful experimentation. The use of the instruments and the selection of appropriate animals for the points under investigation, as well as the operative procedure in each instance, will be considered separately as we study each subject. There are, however, two points in this connection that I desire now to call your attention to. One a point of principle, the other of practice. The first of these is that no experiments should be made upon sentient animals unless the circumstances of the case render the use of narcotics entirely inadmissible, for though we have a perfect right to take the life of a lower animal for any purpose that may directly or indirectly be of value to man, we have no right to inflict upon them any unnecessary suffering. Therefore, the majority of experiments which I propose to make before you are those which can satisfactorily be made on insensible animals.

HOW TO NARCOTIZE ANIMALS.

To narcotize animals, chloroform, ether, opium, and chloral may be employed; chloroform is the most rapid anæsthetic that we possess, but its use is dangerous, particularly to dogs, unless air is also freely supplied. It is generally advisable to chloroform a dog before he is tied down on the operating table, as he appears to suffer more in the act of restraining him than in any step of the operation. I, therefore, generally muzzle the dog, and then put his front legs on my knees, while I sit down and hold his body with my left arm. If now a few drops of chloroform are poured into a towel folded into a cone and held over his nose he can be soon narcotized, the most reliable sign being the loss of sensation in the cornea. As soon as he is insensible he can be fastened down, and the chloroform cautiously continued, or ether substituted for it; his respiration must be closely watched, and if it is found to stop, no time must be lost in performing artificial respiration; and if this fails, the trachea must be opened and connected with a bellows. Laudanum and morphia are reliable anæsthetic agents for dogs, about 2½ c.c. of laudanum, or 0·5 gramme of morphia when intravenously injected, being full doses for medium-sized dogs. When rabbits are to be used, chloral is preferable, given in doses of about ten grains per pound weight of the rabbit. Chloral may also be given in the same proportion to cats and guinea pigs. This is also the best agent for frogs, since opium and morphia tetanize them, and chloroform is apt to be fatal; dose for frogs 0·2-0·5 gramme. Chloroform or any of the other volatile anæsthetics may be readily administered to all the smaller animals, such as frogs, mice, pigeons, guinea pigs, or kittens, by placing the animal under a bell jar, containing a sponge wetted with the anæsthetic. Since the vapor of chloroform is heavier than air, if this agent is used, it is well to have an opening in the top of the jar, into which a sponge can be placed and saturated with chloroform; the action is then more rapid and safer.

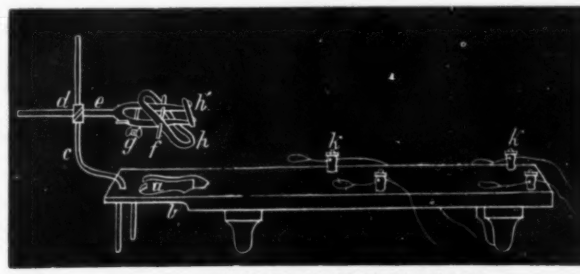


FIG. 1.—CZERMAK'S RABBIT HOLDER.

When it is desired to keep an animal perfectly motionless, curara is used; but since this paralyzes the motor nerves, and hence necessitates the use of artifical respiration, I will defer its consideration until it becomes necessary for us to employ it.

APPLIANCES TO FASTEN LIVE ANIMALS.

The other point that I want now to call your attention to is the method of securing animals. Frogs may be fastened on a board by a cord with a slip knot fastened over each foot and ankle, and secured at each corner of the board; or when they are insensible they may be fastened by passing a tack through the point of the nose into the board and one through each foot. Rabbits and cats are best secured on Czermak's rabbit holder. This consists of a strong wooden board (Fig. 1), mounted on four feet, about thirty inches long, eight inches wide, and four inches high, strengthened at one end by an iron plate, *b*, perforated by a large opening, *a*, to permit operation on the back of the neck, such as dividing the cord, etc. This opening, when not used, may be covered with an iron plate. Screwed into this plate is a strong, vertical stem, *c*, which bears a sliding block of brass, *d*, into which a fork-shaped steel rod, *e*, slides horizontally, and can be clamped fast by a binding screw. The forks of this rod are hollow, and receive the ends of the forceps which secure the animal's head. When it is desired to fasten a rabbit, the bar, *f*, is placed behind its incisor teeth (behind the canines when a cat is used), and the screw, *g*, turned until *h* and *h'* fit tightly over its muzzle, *h'* being always in contact with the lower jaw. The animal's legs are confined by slip-knots passed around each ankle, the cord being secured in the binding screws, *k*.

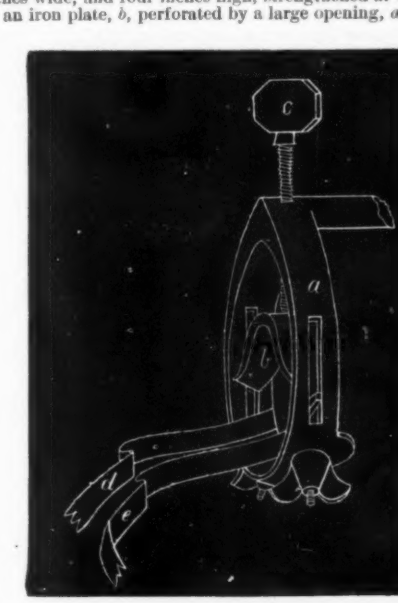


FIG. 2.—BERNARD'S DOG HOLDER.

Dogs are best fastened in Bernard's holder. It consists of a long wooden trough, with holes along the sides for the cords which fasten the legs, while the animal's head is secured by means of a special arrangement (Fig. 2). It consists of a strong metal ring, *a*, fastened to a horizontal arm. The sides of this ring have slits in them, to permit of the up and down motion of a metal compress, *b*, which can be elevated or depressed by means of a screw, *c*, and thus when depressed confine the animal's jaws. The snout having been placed under this compress, the animal is prevented from retracting its head by two straps, *d* and *e*, which are fastened behind the animal's neck, and are connected by their anterior extremities with movable pieces of metal, which can also be elevated or depressed according to the conditions required. A very simple method of fastening dogs, when these special contrivances are not on hand, is to place transversely behind their canine teeth a piece of wood, which, when rendered stationary by tying the animal's jaws together, may serve as a support in securing them.

PHYSIOLOGY OF DIGESTION.

You are all aware, gentlemen, that the appropriation of a definite amount of nutriment forms one of the essential conditions of life, whether of animal or vegetable, and it has seemed to me that we cannot begin more appropriately a series of demonstrations of physiological facts than by following the changes which that material must undergo, and the means by which these modifications are accomplished, before it can serve as nutriment.

We will, therefore, commence our experiments by studying successively the various fluids to whose action the material taken as food is subjected—saliva, gastric juice, bile, and the intestinal fluids—examining to a limited extent their composition, since this branch belongs more particularly to physiological chemistry, while we will study with more detail the character of their digestive action, the circumstances which modify it, and the influence of the nervous system upon their secretion. We will commence, therefore, with the rôle of the salivary secretion.

THE USES AND EFFECTS OF SALIVA.

The uses of saliva are both mechanical and chemical. Mechanically, it assists in the formation of the bolus of food, after having previously aided its mastication, and acts as a lubricant to its passage into the stomach; it aids the appreciation of taste, and by lubricating the surfaces of the mouth and teeth, prevents the adhesion of viscid substances and permits the movements of rapid articulation. Its chemical attributes are even more important; these we will examine in detail presently. The saliva is a remittent secretion formed by the three pairs of salivary glands, to which are added the fluids furnished by the lingual and palatine glands, and the numerous follicular glands of the buccal mucous membrane. We will examine first this mixed saliva.

THE COMPONENTS OF SALIVA.

I have here about 30 c.c. of fresh mixed saliva, obtained by expectoration after stimulating its flow by chewing a piece of rubber tubing. You see that it is opalescent, with quite a decided froth on its surface, from the air bubbles detained through its viscidity, and that there is a marked white precipitate, composed mainly of epithelial cells and salivary corpuscles. (In this other specimen, which has stood for two or three days, a thin pellicle of carbonate of lime has formed.) Its specific gravity is 1.005; its reaction, as shown by the litmus paper, decidedly alkaline. The instances in which an acid reaction has been found in the fluids of the mouth are due to an increased acidity of the buccal mucus from some pathological cause, such as the fermentation of retained fragments of food, the tartar of the teeth; saliva is invariably alkaline.

Of its inorganic constituents, I will only call your attention to the sulphocyanide of potassium and the chlorides.

I have here a few c.c. of saliva which has been filtered, to remove the epithelial cells and mucus. To a portion of this I add a drop of a solution of perchloride of iron, so dilute as to be almost colorless, and you see, as I stir it, a decided red color is developed, showing the presence of the sulphocyanide. Occasionally the reaction fails, but it can almost always be produced if the saliva is evaporated to about one-third of its bulk. There is probably no other one element of an organic fluid which has caused so much dispute as this salt, whose presence I have just demonstrated. The reaction has been supposed to be due to the presence of nicotin, to the presence of acetates, of decomposed matters from carious teeth, to hydrophobia, etc. This reaction may become important in a medico-legal point of view, since it is identical with that of meconic acid; the two substances can be distinguished, however, in a very simple manner. I will add a few drops of a solution of mercuric chloride to a mixture of the saliva and the perchloride of iron, and the color disappears; no such result would have been obtained had the saliva contained meconic acid. The red color produced by meconic acid and perchloride of iron remains unaltered by the addition of corrosive sublimate. The presence of chlorides may be proved by taking this other portion of the filtered saliva, and acidifying it strongly with nitric acid; and now the addition of a few drops of a solution of nitrate of silver causes quite a decided precipitate, which, you observe, dissolves readily in aqua ammonia.

The organic constituents of saliva are albumen, mucin, and ptyalin. The presence of albumen is shown by what is termed the xanthoproteic reaction. To a portion of fresh saliva I add a few drops of strong nitric acid, and you notice that although the mixture becomes slightly turbid, there is no distinct precipitate; upon boiling it becomes clearer and takes on a faint, yellowish hue. I will let this stand for a few moments until it cools off somewhat before finishing the test. To the presence of mucin are due the tenacity and stickiness of saliva. To another portion of the same saliva I will add gradually a few drops of acetic acid, stirring all the time, and the fluid becomes more and more tenacious, until finally the mucin separates in stringy flakes. The test for albumen has now cooled considerably, so we can proceed

with the reaction. You remember I added nitric acid and boiled the fluid with the production of this yellowish tint as the result. I will now add a little ammonia, and the faint yellow becomes very decidedly marked, almost orange-red, in fact, showing the presence, to a considerable degree, of albuminoids. Ptyalin, or "animal diastase," is the substance on which the property of converting starch into sugar depends. It has been obtained in this instance by extraction from the salivary glands of an ox with glycerine. The gland is finely minced and covered, in a corked flask, with absolute alcohol. In twenty-four hours the alcohol is poured off, and as much as possible driven off from the gland by pressure; the residue is then covered with glycerine and allowed to stand for several days, being stirred occasionally. At the end of this time the whole is strained through muslin, and then filtered, and the ptyalin is precipitated from the filtrate by an excess of alcohol. The precipitate can then be collected by subsidence and decantation, and must be dried at a low temperature, over sulphuric acid. It is soluble in water, and differs entirely in its reaction from albumen. The xanthoproteic reaction cannot be produced, nor is any precipitate produced with acetic acid and potassium ferrocyanide.

CONVERSION OF STARCH INTO SUGAR BY SALIVA.

We come now to the study of the most important of the attributes of the salivary secretion, viz., its power of converting starch into sugar.

In each of these three test tubes, which we will number 1, 2, 3, I have placed the same quantity of starch mucilage, made by mixing one grain of powdered starch into a thin paste with a few drops of cold water, and then adding the paste to 100 c.c. of boiling water, and allowing it to boil for ten minutes; then, after standing until the sediment has settled, the clear, supernatant fluid is filtered off and is ready for use. I will now divide this specimen of fresh filtered saliva into two equal parts; one part I add to the test tube marked 2, and the other, after boiling thoroughly for three or four minutes, I add to 3. Into this fourth test tube I will put saliva alone. I will put them all, now, for a few minutes, into the water bath, heated to 38° C. 1, containing starch mucilage alone; 2, containing one part of saliva to three times its bulk of starch mucilage; 3, starch and saliva in the same proportions, the saliva, however, having been boiled, while the fourth test tube contains saliva alone.

CONSTRUCTION OF A WATER BATH.

While we are waiting until the test tubes have been subjected for a few minutes to the heat of the water bath, I will explain to you the mechanism of the bath (Fig. 3). The bath itself is made of copper, and is twelve inches in diameter and five inches deep; at one side it bulges out, and in the projection thus formed the thermometer and gas regulator are placed. The top consists of a movable copper plate, perforated with several large holes, into which evaporating basins can be placed, while one of them receives this rack for test tubes. Each hole is provided with a cover, which is made with a depressed margin fitting into a groove around each hole so as to make a water joint and prevent escape of steam, the vapor being condensed and falling back into the bath as water. The water is kept at the same constant level by the siphon arrangement. It consists of a glass tube bent twice at a right angle, one end dipping into the bath and the other into this flask containing water; the cork in the mouth of the flask is also perforated for the passage of a straight glass tube, one end of which dips in the water in the flask, and the other communicates with the air. The siphon tube is then filled with water by blowing into the straight tube and so driving the water over into the bath, and then the straight tube is pushed down into the water until its lower end is at the level at which it is desired to keep the water in the bath; this end must be slightly above that of the siphon tube, the vertical difference between the level of these ends forming the effective siphon power. When, now, the level of water in the bath falls below the end of the straight tube, from evaporation, the siphon acts, and the water flows over from the flask into the bath, until the water in the latter attains its former level.

THE HEAT REGULATOR.

The most important part of the whole arrangement, however, is the gas regulator, modified from Bunsen (Fig. 4), which keeps the bath at a constant temperature. It consists of a wide glass tube, about six inches long, with a narrow horizontal arm coming off at its upper part, and divided at about the center by a horizontal partition or septum, from which a tube runs down nearly to the bottom of the large tube. The large tube is fitted with a perforated cork, through which passes a small tube open at both ends, and having, at about an inch from the lower end, a minute opening in one side. When wanted for use, a quantity of clean, dry mercury is poured into the large tube (part of which runs down the inner tube from the septum, and compresses the air in the lower chamber), until there is about an inch of mercury over the septum. The cork is then put in, and the horizontal arm connected with the gas main, and the straight tube with the burner under the bath. When, now, the thermometer shows that the water is heated up to 38° C., the inner tube is pushed down until its lower end comes in contact with the upper surface of the mercury which has risen in the large tube, partly from the expansion of the mercury from the heat of the bath, but more especially from the expansion of the air compressed below the septum driving the mercury up the tube. When, now, the small tube is pushed down to the mercury, all the gas is shut off from the burner except as much as can pass through the minute hole in the side of the inner tube, which you see is just enough to keep the burner lit. If, now, the bath should cool, the mercury and hot air would contract, and more gas would pass until it is again heated up to the temperature at which it was set, when the rising mercury would again shut off the gas. By this means the temperature can be kept nearly constant for weeks. We are now ready to examine our results of the combination of the saliva and starch.

Let us now examine the test tubes—

In No. 1, which you remember contained starch mucilage alone, the addition of a few drops of iodine solution, so dilute as to be almost colorless, causes the instant appearance of the characteristic *blue color* of the iodide of starch, while, if I add a few drops of Fehling's solution to another portion of the same specimen, adding merely enough to give the fluid a blue tinge and then boil, there follows no decoloration or deposit, showing that the starch employed contains *no sugar*.

To a portion of No. 2, which contained starch mucilage and saliva, I add a few drops of the same solution of iodine, and you see the result is very different; there is no such decided blue as occurred in the first instance, merely a faint tinge of *violet*, from the presence of dextrine. The starch has disappeared. To another portion of the same specimen I now add a few drops of Fehling's solution, and upon boiling there is a copious, yellowish-red precipitate, due to the reduction of the cupric to cuprous oxide, and showing the presence of a considerable quantity of sugar. The sugar has replaced the starch.

With the fluid from No. 3, which contains starch and saliva, which latter, however, you remember was boiled, a few drops of iodine gives still the reaction of starch, while boiling with Fehling's fluid shows no sugar. You will learn from this that boiling destroys the property possessed by saliva, of turning starch into sugar. In some instances, when there is an appreciable quantity of proteids in the saliva, the blue of the Fehling's solution is changed to violet.

With the fluid of No. 4, containing merely saliva, there is no reaction to iodine, and the Fehling's solution, when boiled with it, has, I think, more of a violet tint than before.

You have seen, then, that when starch mucilage is subjected to the action of saliva *for a few minutes*, at a temperature of about that of the body, the starch is entirely converted into sugar.

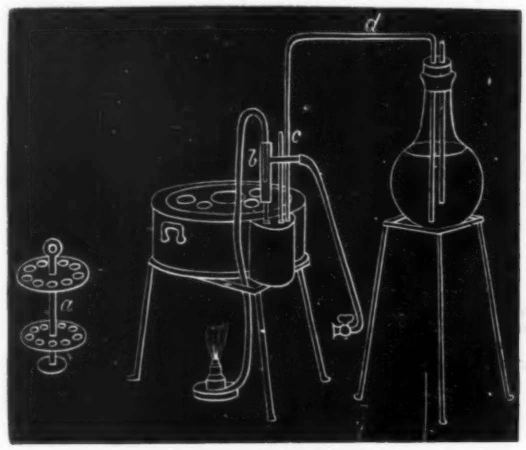


FIG. 3.—WATER BATH.

a. Test-tube Rack. *b*. Gas Regulator. *c*. Thermometer. *d*. Siphon arrangement by which the water is kept at a constant level.

I lay stress upon the condition "for a few minutes," for I want you to appreciate that this conversion is not instantaneous. It was taught by Bidder and Schmidt, that momentary contact of the saliva with starch was all that was necessary to turn the starch into sugar, and an experiment which has been long used to substantiate this view, and which appears, at first, to demonstrate its truth, is really by no means conclusive. The experiment is as follows: Into this beaker, which contains a little saliva, warmed up to 40° C., I will add, drop by drop, a solution of starch which has been colored blue by iodine, and you see, as each drop falls, it is decolorized. It has been supposed that the starch was instantly converted into sugar, breaking, in this manner, the combination of the iodine and starch. That this view, however, is erroneous, was pointed out by Schiff. He showed that the decoloration was due to the conversion by the saliva of the iodine into hydriodic acid, and that many other organic fluids, which would not convert starch into sugar, would decolorize iodide of starch.

I have here a quantity of dog's urine, which you see also decolorizes the iodide of starch; and, if I add a little morphia to another portion of solution of iodide of starch, you see the color disappears. In neither of these substances is there the property of converting starch into sugar, but the result is due to the oxidization of the iodide. There are two practical points to be drawn from this demonstration: First, since the starch is not instantaneously converted into sugar upon contact with the saliva, mastication should be prolonged and thorough, though by no means can all the starch be converted into sugar in the mouth. And second, that starch cannot be considered as a conclusive test for the presence of iodine in the various secretions. It is often desired to test urine, milk, etc., for iodine, as in cases of iodism, and all that is deemed necessary is to add a solution of starch mucilage to the suspected liquid, and if the characteristic blue color does not appear, it is concluded that no iodine is present. The procedure is doubly fallacious, not only because these very fluids have the power of decolorizing solutions of the iodide of starch, but even when iodine is present, it is not in the form of free iodine, but as hydriodic acid, the very agent through which this decoloration is effected.

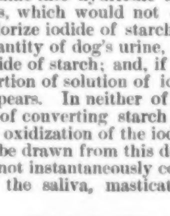


FIG. 4.—BUNSEN'S GAS REGULATOR.

a. Tube connected with gas main. *b*, with the gas burner. When the bath has been heated to the desired temperature, the tube, *b*, is pushed down until its lower surface touches the upper surface of the mercury, *c*, thus shutting off all the gas except what can pass through the minute opening, *d*. The bath then cools, and the expanded mercury and hot air compressed in *e* shrink and more gas passes until the bath is again heated up, when the expanding mercury again shuts off the gas.

Let me anticipate here what I will demonstrate to you directly, viz., that cold saliva has little, if any, action on raw starch, unless in contact for some hours; yet you see that if I add a little iodine to this mixture of raw starch paste and saliva no blue coloration is produced, while the iodine will act on raw starch as I now show you. This is another proof that the decolorization was not due to the conversion of starch into sugar.

Continuing our study of the chemical properties of mixed saliva, we have now to examine the influence of temperature and of acids and alkalies on the diastatic properties of saliva. I have here four test tubes, into each of which I introduce a little saliva with a pipette. 1 I place in a mixture of salt and ice; 2 in the rack on the table; 3 in the water bath at 40° C., and the fourth I boil vigorously for a few minutes, and allow it to cool. After they have been reduced to the temperature of their respective media, I add to each a little starch paste, and, after waiting a few minutes, test each of them for sugar. None is found in 1; a little in 2; more in 3, and none in 4. I now place the remaining portions of 1 and 4 in the water bath, and, after waiting a few minutes, test them each again for sugar. Sugar is now found in 1, but none in 4. Therefore, you have seen the power of saliva for converting starch into sugar is more or less suspended at a low temperature, while it is destroyed at a high temperature.

I have shown you that the conversion of starch into sugar is by no means instantaneous, and that even with the most prolonged mastication some unconverted starch is swallowed, and it, therefore, becomes interesting to know whether the acid of the gastric juice will interfere with the process. It is also known that in some pathological cases the reaction of the mouth is acid; is the conversion of starch into sugar thereby prevented?

In these three test tubes 1, 2, and 3, I have placed equal bulks of starch mucilage and saliva. To 1 I add an equal bulk of distilled water; to 2 an equal bulk of distilled water containing 0·65 per cent. of mercantile muriatic acid, which forms an acid of about 0·2 per cent. of HCl, being about the degree of acidity of the gastric juice; to 3 I add the same bulk of 10 per cent. muriatic acid. We will put them each into the water bath. After allowing them to remain for a few minutes I will test them each for sugar. It is found in 1 and 2, but none in 3. I will now carefully neutralize the acidity of 3, by adding, drop by drop, a weak solution of caustic potash, carefully avoiding excess until this litmus paper which I have put in the tube gradually becomes pinkish instead of the decided red which it showed before. I will now put it back in the bath, and in a few minutes test again for sugar; and you see it is present in considerable quantity. You will learn from this that although all the starch does not become sugar in the mouth, the acidity of the gastric juice does not interrupt its conversion, and if from any cause either the secretion of the mouth or that of the stomach should become extremely acid, the process will again go on when the excess of acidity has been neutralized by the intestinal fluids, which, you know, are alkaline. It is also well for you to know that the diastatic action of saliva is *destroyed* by the caustic alkalies, not recoverable upon neutralization; but the weaker alkalies, such as lime water, ammonia, carbonate of soda, etc., merely suspend its power of converting starch into sugar. You have, therefore, in these facts the rationale of the administration of alkalies in cases of excessive acidity, either of the mouth or stomach, as in pyrosis, to permit the digestion of amylaceous articles of food, while you also see that in the many cases in which it may be necessary to administer alkalies, there is no danger of arresting this function of the saliva, since, when neutralized in the stomach, the process again goes on.

You have seen that saliva converts starch mucilage rapidly into glucose; the action on raw starch, however, is much slower and more complex. It does not transform it directly, but extracts from it a part, which alone is converted into glucose, while the rest remains unaltered.

Those of you who have examined starch granules under the microscope know that each granule consists of a number of layers, arranged in an eccentric manner around a point called the hilum. These layers consist alternately of two substances, which are termed respectively starch cellulose and starch granulose. The latter alone is colored by iodine, unless the granules have been previously acted on by sulphuric acid or chloride of zinc. Saliva acts only on the granulose, and hence, when raw starch has been subjected for several hours to saliva, the granules are not colored by iodine though they still retain their form. The saliva has extracted part of the starch granules, the granulose, which it has converted into glucose, while it still leaves intact the cellulose. With starch mucilage, made with boiling water, however, the case is different; under these circumstances the starch is totally changed; no residue can be discovered upon microscopic examination. The cellulose has itself been altered by the action of the boiling water, and both the cellulose and granulose are changed into dextrine, and it is the dextrine which is converted into glucose. That the cellulose is really the agent which prevents the action of saliva on raw starch, can be readily proved by removing the cellulose artificially, as by powdering starch granules with fine sand, when the cellular envelope is broken up, and

an aqueous solution of granulose can be readily made, which will be comparatively rapidly acted on by saliva.

That the conversion of starch is due to the presence of ptyaline, is proved by the experiment showed to you a few minutes ago, in which you saw that boiling saliva destroyed this property, from which, on the other hand, you would be justified in inferring that ptyaline is what is known as a ferment, and acts "catalytically," a convenient expression of our ignorance.

There is only one other point that I want to call your attention to in reference to the action of mixed saliva on starch, or rather, I should say, in reference to the result of that action; and that is that sugar dialyzes and starch does not.

Into one of these dialyzers, formed by tying a piece of parchment paper over one end of a bell-shaped tube, after having found by testing that they are perfectly tight, I have placed some dilute starch mucilage; in the other, another portion, with some saliva. Both were then suspended in separate vases of water for twenty-four hours. We will now examine them. Upon adding iodine to the fluid around the first there is no evidence of starch, nor upon testing with Fehling's fluid of sugar. While in the fluid around the second there is no starch, but there is decided evidence of sugar. Sugar therefore, dialyzes, but starch does not. All the preceding experiments can be made with an aqueous infusion of the salivary glands of most of the lower animals; *e. g.*, guinea pigs, oxen, sheep or rabbits.—*Medical and Surgical Reporter.*

PREPARATION OF PEPSIN, AND THE GOOD TO BE OBTAINED FROM IT.

By JOS. ADOLPHUS, M.D., of Georgia.

IN 1872 I read an interesting paper on the preparation of Pepsin, by an American author whose name I have unfortunately forgotten. The simplicity of the process, the way of obtaining the ferment according to the manipulations of this method, so impressed my attention as to fasten itself on my memory.

The process is so simple and easy of execution as to permit the whole thing being performed in a parlor, and is as follows:

The mucous coat of the calf's stomach is carefully stripped from its other attachments, and is finely chopped. It is then macerated in water, slightly acidulated with c. p. hydrochloric acid of sp. gr. 1·17, at a temperature of between 80° or 90° for several days, during the time being frequently stirred, so as to wash out all the soluble pepsin from the gastric glands. The whole is then strained through muslin, and the residue pressed or squeezed with the hands to force out as much of the fluid from the magma as is possible.

The second step in the operation is to prepare a saturated solution of common salt in cold water, of which a quantity equal in bulk to the above solution is added to it, and the whole put aside and at rest for twenty-four or forty-eight hours. The pepsin will soon separate from the mother liquor and float on the fluid, from which it can be taken by a common spoon or perforated skimmer; it is then dried by pressing it between paper. Pepsin in this condition resembles plate paper and parchment. It is next dried in a cool, dry place, free from dust, and when well air dried, nine times its weight of good well dried sugar of milk is added, with which it must be well and thoroughly triturated. Ten grains of this represent one of pepsin. I have found the pepsin immediately after its preparation, and before it is air dried, to be readily soluble in glycerine at temperature of the body in the proportion of 15 grains to the third ounce.

I have twice prepared pepsin after this formula, which is much the cheapest yet that has come under my notice. If the sugar of milk triturate is kept in quantities of small bulk in well secured glass coppered bottles, it will in a dry climate keep for two years. In the South it will not keep six months, if the least exposed.

The author of this process, if I recollect aright, observed that one grain of this pepsin dissolved in a few ounces of water slightly acidulated with hydrochloric acid, will dissolve 500 grains of coagulated albumen. The glycerine process of obtaining pepsin is, to my mind, the best, but not as easy as the above. The only objection to be urged accuses the glycerine of taking up mucous and other impurities along with the pepsin. This, however, is reduced to a minimum if the tissue is well washed in soft water, so as to remove the mucus, which can be largely effected with care. I have frequently prepared pepsin after this manner, which is as follows:

The mucous coat of the calf's stomach, obtained in the same way as the other process, is well washed in clear, lukewarm soft water to free it from mucus. It is then well dried between cotton cloths, to abstract all superfluous water and moisture. After this it is chopped fine, and placed in a wide mouth, well fitting glass stopper bottle, and covered with pure glycerine at 100° F.; then the stopper is carefully replaced so as to exclude the air and moisture. The bottle must be kept in a warm place and frequently shaken. Three days' maceration is long enough. The glycerine is then decanted, and the magma, which has been well pressed, is replaced in the bottle, and half as much water as there was originally of glycerine, slightly acidulated with hydrochloric acid (about 3 drops to the fluid ounce) is poured on it and the bottle again placed in a warm place, and frequently shaken. Eight or ten hours is long enough for this last maceration. The fluid is decanted, and the magma is pressed. After allowing time to settle, the fluid is carefully decanted from the dregs. The decanted fluid is then evaporated to one fourth its bulk, and is added to the glycerine first obtained. This will keep for several years. I have had as good results from it after three years as when first prepared. It should be kept in bottles of one or two ounce bulk, well stopped, so as to exclude the air.

If properly prepared, 10 drops of this will dissolve 250 grains of coagulated albumen in water, slightly acidulated with hydrochloric acid.

Now for the use of pepsin. Omitting dyspepsia and the long list of its kind in chronic affections, for the cure of which it has been so well applied, few have thought of turning its valuable properties to assistance of patients suffering from acute diseases, to weather the storm till convalescence comes around.

In acute diseases the safety of the patient, in a great measure, depends on the quantity and duration of resisting stamina the organic forces are able to present to breast the surging wave of the destroying process called disease. Comparatively brief, indeed, is the time consumed by these acute diseases in making their march, but brief as it is, the whole organic life forces of the economy are being rapidly sapped in different ways, but notably in largely cutting off the supply of nutrition in different ways, and, as a secondary result, the impairment of the integrity of the histologic elements of those tissues which largely compose the organs most essential to life.

Not having the space to enlarge on this interesting topic, let us proceed to the practical facts.

In typhoid fever experience has taught me that the major percentage of deaths occur between the close of the second week and the middle of the third; just the time when inanition would tell the heaviest on the resisting forces of the economy. If we omit such accidents as hemorrhage, perforation, and the like, which are few in comparison as a cause of death, in typhoid fever, with exhaustion, the case clearly presents the truth of my proposition.

I hold that it exercises dynamic force on organic and constructive processes of the economy after it enters the blood; by this means it increases the dynamic forces of nutrition, and saves life by increasing the molecular energies between the nutritive juices and the elements of the tissues. There are abundant facts to prove this. Very frequently convalescence is defeated because the patient is too much exhausted to get well.

This spring I was asked by a medical friend to see with him an old man who was very ill with typhoid pneumonia. The main features of his case, aside from the lung trouble, was very great exhaustion. I suggested pepsin, and the wine of it, which was of recent make, and was proven good, was used. In twenty-four hours a decided change for the better was observed, which brightened every day till convalescence was completed.

Two years ago I attended a lady through an attack of pneumonia. Her recovery was very problematic, on account of the extreme debility she was in. As a last resort I gave her pepsin that I had prepared with glycerine. Immediate improvement, almost, was visible after the taking. A notable point in these cases is the increased demand for food these patients soon make after taking the pepsin.

It is evident to all straight thinking people that, anything which will increase the powers of nutrition and assimilation in people suffering from acute disease, will increase also their chances of recovering.

This line of reasoning and the practice founded on it, apply to sick children in a very pointed manner.

Appropriation of nutritive pabulum can alone fortify against the collapse of the life forces and the cessation of function.

In pneumonia the largest percentage of deaths occur during the latter part of the first week and the beginning of the second. Death takes place from heart debility.

Without stopping to investigate the remote causes of death in pneumonia, we simply inquire: Will the intelligent administration of pepsin contribute anything toward retarding or removing the proximate cause of death? I think it does, and this, too, on the simple principles already alluded to.

When there is rapid destruction of tissue, the strain falls heaviest on those organs that are most used in carrying on the functions of life; among these prominently stand the heart and respiratory.

This fact points sharply to children, and explains why death in them so frequently commences at the heart and lungs. In point of fact, the major part of instances in which death is supposed to commence at the brain in children, is no more than defective blood supply to the brain, either in quantity, from heart feebleness, or in quality, from lung defectiveness.

The abdominal affections of children being attended by great emaciation and exhaustion, the value of pepsin to them cannot be well overestimated. The period of the disease in which it is proper to use pepsin is at the time, or immediately after, the disease has reached its height. In typhoid fever this is true; in pneumonia, seeing how rapidly heart failure comes on, the acme is reached no doubt very early, often on the third day.

The conditions that call for stimulants also call for pepsin. While stimulants can spur the naked and jaded energies into quicker movements, pepsin communicates to the molecular elements of the tissues a higher impulse, and awakens in them a more exalted energy to take food and live.

The dose of pepsin in all acute diseases must necessarily be small, not to exceed one-eighth or one-fourth of a grain every two or three hours, and always in a weak solution of hydrochloric acid, which must be strictly chemically pure. It may be, though in an humble way, the principles and facts set forth in this paper are a new departure from the philosophy of the schools.—*Southern Medical Record.*

MICROSCOPICAL OBSERVATIONS IN YELLOW FEVER.

By J. B. MARVIN, M.D., Professor of Chemistry and Microscopy, Hospital Medical College; President of Microscopical Society, Louisville, Ky.

THE literature of yellow fever is very voluminous, but our knowledge of the pathological anatomy of the disease is very meager. I believe by calling to our aid chemistry and the microscope most valuable additions will be made to our knowledge of the disease. While resident physician at the Louisville Yellow Fever Hospital, I improved my opportunity by making frequent and extended chemical and microscopical examinations. I present you to-night a brief summary of my work as far as I have finished. I present you bare facts, illustrating my remarks with mounted specimens. I offer no theories or deductions from my work, believing that our knowledge of this disease will be best advanced by a careful and conscientious record of facts instead of vagaries and theoretical hypotheses.

The Breath.—Pure glycerine was smeared in the center of a clean new glass slide, and held an inch or two from the nostrils or mouth of the patient. After a few minutes' exposure to the breath the slide was examined under the microscope. Large quantities of very active vibrios were revealed; they were of the short, dotted variety. There were also found roundish, oval, moving bodies, probably bacteria.

The Blood.—A drop of blood from the finger was received on a slide covered with thin glass, avoiding pressure, and examined. The corpuscles were more or less jagged and crenated. In some severe cases there was a large increase in the number of white corpuscles. Scattered among the corpuscles were small oval and rod-shaped bodies, yellowish in color, and quite active in their movements. They were probably bacteria, but do not resemble vibrios or any form of bacteria that I am familiar with. More extended observations in this and other fevers must be made before attaching undue importance to the existence of these bodies in the blood and breath. The question naturally suggests itself whether these bodies are the cause or the result of this disease. I incline to the belief that they are the result. Every precaution was taken, in making these examinations of the breath and blood, to avoid contamination. The examinations were made with a Folles one-tenth inch immersion objective and a "B" ocular.

The Urine.—The points of interest in the urine were the constant presence of granular tube casts, renal epithelium, and granular matter, all more or less stained yellow with bile; the tube-casts in severe cases appearing as soon as the second day, more generally on the third or fourth day of the attack. In all cases there was an admixture of vesical epithelium. In some few cases there was a great abundance of vesical epithelium for a few days before the appearance of tube-casts or renal derivatives. The quantity of tube-casts may be small or very large. The severer the case, the greater the quantity of casts. Tube-casts are very valuable guides in the prognosis of the disease. As convalescence sets in, the casts generally disappear. In some cases, however, they continue in considerable quantity till after the patient is up and walking about.

The Vomit.—After the stomach had been emptied of food the vomit was glairy mucus and epithelium streaked with blood, bearing a striking resemblance to the sputum of pneumonia. Bile in greater or less quantity was generally present. Frequently pure blood was vomited in large quantities, the ejection of blood frequently alternating and following black vomit. The coffee-ground or black vomit consists of blood more or less digested and broken down by the gastric juice and bile. There were large quantities of vibrios, an oval, not recognized growth, and frequently very large crystals of hæmatoidin.

The Liver.—The principal pathological changes are found in the liver. The color may be bright yellow, orange nutmeg, or normal. The organ is generally enlarged, the enlargement being very slight in some cases. It is very firm and tough. On section the hepatic cells are granular, frequently stained with bile, and have undergone almost complete fatty degeneration. There is generally an increase of the connective tissue and a consequent pressure upon and destruction of the cells. In one case, aged twenty-seven, not a drinker, who had suffered at intervals for two years with malarial fever, there was an enormous increase of the connective tissue visible to the eye, giving to the organ the appearance found in cirrhosis. On section all the appearances of cirrhosis were found, with marked fatty degeneration in parts, and in other places amyloid degeneration.

The Kidneys.—The kidneys are congested and in some cases considerably enlarged. On section there are found tubal and inter-tubal hemorrhages. The tubes are filled with granular matter and epithelium; in some parts the tubes are empty and completely denuded of epithelium. There is frequently fatty degeneration, slight in degree. In short, the kidneys present all the appearance of Bright's disease.

The Spleen.—The spleen presents no constant or marked deviation from health. In some cases, which gave history of previous malarial trouble, the organ was enlarged and pigmented. In other cases there was no enlargement or pigmentation.

The Stomach.—This organ does not appear congested as stated in text-books. The mucous membrane is pale, and is not destroyed. In only one case was there any thickening of the membrane or enlargement of the rugæ. On section, the glands and villi are but slightly changed. The villi, especially their free extremities, contain blood. I am convinced that the changes stated to have been found in this organ are really post-mortem changes, due to the fact that examinations were not made until some hours after death. Post-mortem changes are very rapid, and the sooner an examination is made the better.

The Intestines.—The intestines generally present the same appearance as the stomach. In some cases there is marked congestion, and the villi present appearance of acute catarrh.

The Bladder.—In those cases where there is suppression of the urine for any length of time before death, the bladder is badly congested, the mucous membrane being purple in spots. In other cases there is no marked change. The gall bladder is full of bile, frequently greatly distended and badly congested.

The Lungs.—This organ presents no constant change. In several cases there was recent pleuritic adhesion; in one case there was severe pneumonia. In some cases the organ is completely collapsed. The color is generally dark and mottled; hemorrhagic spots are frequent.

The Heart.—The heart may be full or empty. In some cases there is marked fatty degeneration, the walls being pale and friable. Most generally the organ is normal. The pericardium always contains more or less reddish fluid, the amount varying from one to six ounces.

The Brain.—No lesions were found in the cerebrum, nor constant change at the base of the organ. In cases which had marked delirium, there was marked congestion and softening at the base. I have not finished my microscopic examination of this organ.—*Louisville Medical News.*

APIOL, the active principle of parsley, discovered by Taret and Homelle in 1855, is an oleaginous amber-colored liquid, soluble in water in any proportion, of an acrid taste. It may be given in capsules. According to Marotte, of La Pitié, it brings on the menses, regulates menstruation, and calms the pains by which it is often accompanied. It has no action on the pregnant womb.

DISCOVERING SPERMATOZOA.—Ronvière (*La France Médicale*) gives the following: In summer cover the urine, in a bottle, with a layer of benzine, to prevent decomposition. In winter this is not required. Let it remain at rest for twelve hours. Decant the greater part, leaving the muddy bottom part. Mix with this about its volume of sulphuric ether in a test tube; shake violently. In a few moments the ether rises to the top of the liquid, carrying the spermatozoa with it, and can be drawn off with a pipette for examination.

PREPARATION OF HYDROGEN GAS.—H. Kollmann.—Hydrogen is easily obtained by treating ferro-manganese with dilute sulphuric acid. The gas thus obtained is not merely adapted for ordinary laboratory purposes, but also for Marsh's arsenic test.

AGRICULTURE OF JAPAN.*

Travelers in foreign countries on their return home are not infrequently charged with giving exaggerated accounts of the wonderful things they have seen, and it is not unlikely that such charges are sometimes just. It is not an easy matter to form a perfectly correct opinion of any country or any people by simply making one short visit, yet some travelers will form a much more correct opinion than others. President Clark, from his previous acquaintance with other nations, could not be otherwise than a pretty good judge of the real character of any people with whom he might associate, and it was with no small degree of satisfaction that the large audience gathered in the hall of the Hingham Agricultural Society, on the evening of December 2, to listen to an account of the manners and customs of the people of Japan.

There are at least two directly opposite ways of looking at the habits and customs of a foreign people. If a person goes abroad with the belief that his own nation is perfect, or at least the very best in every respect of any nation on earth, he will find very little to approve in the customs of foreigners; but, on the other hand, if he leaves home just a little soured from any cause, it would not be strange if he found very much to admire. Almost every nation must possess both merits and faults peculiar in a certain degree to itself, and that traveler is most wise who can see merits wherever they exist and who is not afraid to criticise wherever criticism is needed.

It is but a short time since English readers have had a chance to know comparatively anything concerning the inhabitants of Japan, and even now the letters of tourists sent to our newspapers from that country are very few and far between. The empire of Japan, now our next door neighbor at the west, consists of nearly four thousand islands, some half dozen only of which are of comparative importance. The whole area of the empire equals something near 170,000 square miles, or three and a half times as large as New England. Niphon, the largest island, is about 900 miles long, and in some portions, 240 miles wide, and extends through more than ten degrees of latitude, from 29° to 41°, thus giving the country a climate favorable to both animal and vegetable life. At Sapporo, the seat of the agricultural college which President Clark established, the snow sometimes falls to the depth of two feet in winter, but when the ground is once covered, there is no rain, ice, nor snow crust to interfere with travel. The mineral wealth of the empire is very great, coal especially being very abundant, while petroleum is found in limited quantity. The people are both patriotic and courageous, and much better farmers than their ancestors of a few centuries ago. They have many peculiarities as a people, particularly in their tastes for personal adornment. India ink is used very freely by everybody for marking the skin, the finest silk goods being imitated in the naked skin, so that if a person is clean, he always has a clean dress, and one, too, which never wears out.

In mechanical work, the Japanese are particularly handy, their paper being the very best in the world, while their lacquered work is admired everywhere. It is supposed that, at the Centennial Exhibition at Philadelphia, the Japanese exhibitors sold fancy and useful articles to the amount of nearly twenty million of francs. The Japanese sword is of superior excellence, and is frequently more costly than one's real estate. The speaker showed two swords similar to those carried almost constantly by the better classes; the smaller for ordinary protection, the larger heavy enough to cut a man in two, from shoulder to hip, with a single blow. The wearing of swords is, however, becoming less fashionable since the government has taken measures to prevent it. Until within a few years, every boy at school, as soon as he arrived at a certain age, was allowed to wear a small sword, and when arriving at maturity, was entitled to the long one, also. The men, however, have very little use for their weapons, because everybody minds his own business and thoroughly respects the rights of others. Farmers hold a high rank in society, even higher than merchants. Great progress in educating the youth has been made within the past few years, the Massachusetts system of public schooling being adopted throughout the nation, the schools being free to both sexes.

Animals have not been valued very highly in an agricultural point of view, sheep being neither consumed for food, nor their wool worn in clothing, but a great change is being wrought in this respect. Not long since, $25,000 worth of sheep, cattle, and horses were imported to Japan from California for one farm alone. Of course, this is a government farm. The value of cows' milk as food, either in the form of milk, butter, or cheese, has been hardly known till the Japanese Embassy visited the Massachusetts Agricultural College a few years since. Government officials seem to be very humble and economical in their habits.

The taxes are fixed for six years in advance, so that the people can know just how much money they will have to raise, and the government expenditures are kept rigidly within the appropriations. The highest rulers disdain extravagance in dress or personal ornamentation, claiming truly that in these there is no dignity. Government taxes are now levied at the rate of two and one-half per cent.; while formerly they have, at times, been as high as from fifty to seventy per cent. Honesty is one of the commonest virtues, no bolts or locks being used upon any of the dwelling houses.

The dwellings are built of bamboo, and are very simple and cheap structures. The furnishing is also very cheap, there being few, if any, chairs known in the country. Tables are raised but a few inches above the floor, and the people sit upon their heels while at dinner. Nearly all the women carry a small block of wood with a soft side for a pillow, and everybody takes a nap in the day time. Food is poked into the mouth with small sticks from little hand basins. A first rate house can be built for $30, and furniture costs nothing. Shoes are worn on the street, but are always left outside when entering a dwelling. Bread and meat are rarely eaten, boiled rice being the standard dish, and on this food the people are very tough and hardy. Men draw carriages in place of horses, and make a very handy team, as they can attend to the getting of their own dinner at the end of the route. It saves harnessing and grooming.

The speaker had hired two men to run with him forty miles a day, for a cent a mile, and board themselves. This was very cheap fare for a "pull*man*" car. Many things are eaten in Japan which Yankees would hardly relish. The root of the common burdock is a common article of food, as are, also, the bulbs of the tiger lily. Fruits are eaten green, peaches, pears, and apricots being in their prime when nearly grown, but while they are as sour, hard, and unpalatable to an Englishman as a green walnut. Melons are also eaten green, as we eat cucumbers. The Japan orange, he thought, was the best fruit he had ever seen in any country. Tea is used by all classes, but there is a great difference in the value of different grades. A few choice leaves sell at home as high as eight dollars per pound. Of course the quantity produced is very small. Alcoholic liquors are indulged in to some extent, but drunkenness is almost unknown, especially in public. Noisy carousals are among the things unheard of in Japan; everybody being polite and courteous as a rule. Smoking is a universal custom, but the amount of tobacco used is very small, a pipe full making only three whiffs, and three pipes full being a regulation "smoke." Everybody smokes at a certain hour, when the factories stop and all work ceases. At the ninth whiff work begins again, and they mean business when they do work. No shirking or cheating, but the men run as though life depended upon getting a certain amount of work done in a given time. All hands sleep at noon just where noon finds them. Children are brought up in a way that Yankees would call queer. They are often tied together, a small one to the back of a larger one, who goes right on with its play or its sleeping, as though entirely independent of a charge, and the little one accepting the situation as a matter of course.

Rooms are heated by burning charcoal in open bowls in the center of the room, while the inmates lie on the floor with their heads toward the bowl of coals. Soap is but little known, but the people bathe often and are really cleanly. They have had very little use for cattle or horses; a good pair of farm horses can be bought for $13. Bulls are sometimes used for carrying burdens, and cows are kept for rearing bulls, but beef eating and beef killing are almost unknown. Butchers are outlaws; and a tanner of hides is about the lowest being in the scale. Gen. Grant would hardly add to his honors were he to visit Japan in the capacity of an ex-tanner. Since the introduction of a few improved cows into the country, milk is becoming an article of food, but at a dollar a quart is, of course, used in very limited quantity.

A white horse is kept in some of the stables as a sacred animal, and a small coin and a single bean are deposited in front of it by each visitor, the horse getting the bean and the attendant the coin. Many things are done directly opposite from our own ways, as the horse is backed into his stall, the saw and plane are pulled instead of being pushed, as with us. The horse is shod with straw shoes, put on by a blacksmith who sits when he works. Books are printed on one side of the paper only, and the work begins on the last leaf, so that one reads backwards. The lines also run down the page instead of across it. Candles are hollow, and are made from poison sumac. The people never kiss, but show their deference and respect by stooping and touching the forehead to the ground or floor. Labor is very cheap, so that eggs are hatched by hand as cheaply as in the natural way.

The land is kept entirely clear from weeds and all useless vegetation. Irrigation is very commonly practiced, even where much hand labor is required. The tillage is also very thorough, and constant cropping is carried on without deterioration of the soil. Night soil is saved with particular care, and is applied to the growing crops just when it will do the most good. A famine is of rare occurrence, as all are industrious, provident, and frugal. The house windows being of paper, the inhabitants live outside much of the time, and much taste is shown in the cultivation of flowers near the home. Everybody appreciates beauty, and the most common flower, whether on public or private grounds, is never plucked by the traveler. The people, old or young, never steal flowers. Rice is the main crop, and is grown in wet land, into which leaves and rubbish are trodden for enriching it. The grain is grown for about a dollar per bushel.

Tea growing is a great industry, and some of the tea plants are 150 years old, and some plantations produce over $3,000 worth per acre. Labor is very cheap, ranging from six cents per day for women, to double that for men.

The speaker gave some account of what the government is now doing in the way of improving the agriculture of the country, by establishing the Agricultural College at an annual cost of $45,000, and that where money is many times more valuable than with us. Seeds of trees are being imported, and the plants grown are given away to the people who will set them out and care for them. In short, Japan is doing with a will and a rush what some of the older nations are still refusing to do at all or very tardily. The smartest men among them have been sent abroad to find out what there is in the world better than their own, and with authority to purchase at the government's expense.

President Clark closed his lecture by congratulating the people of Massachusetts that their Agricultural College is appreciated abroad, even if it is not at home. The lecture occupied full two hours, the reading being frequently interrupted by the inimitable acting of the President, interspersed with conversational description of the large collection of Japanese curiosities displayed upon the platform; but even after this lengthy feast from which not a single hearer withdrew to its close, the audience were not yet satisfied, but drew around the platform and kept the speaker busy answering questions for nearly another hour, or till the janitor of the hall reminded the company that the midnight hours were drawing near. We have no doubt that the lecture took a little of the conceit out of the mind of the average Yankee present, and that many who listened went away with a kindlier feeling towards our cousins on the other side.

* Notes from the lecture of President Clark, delivered before the Massachusetts State Board of Agriculture at Hingham.—*New England Farmer.*

HORTICULTURE IN FAIRMOUNT PARK.

By Margaret P. Janes.

An important feature of Fairmount Park is its Horticultural Hall or Conservatory, and the gardens attached; and remarkably attractive to the eye is the present collection of exotic trees and plants within the tasteful and magnificent edifice, as is also the beautiful arrangement of flowering and foliage plants without, that are on every side. A delightful and comprehensive view of this part of the park is afforded from the promenade and outside gallery extending all around the large hall; and when a Centennial visitor happens to take observations from thence, he recalls the hundred and fifty or sixty buildings which dotted the ground two years ago, and may well exclaim: "What a transformation from the *united city* to a flowery kingdom, and to pleasant sylvan scenes." Nature and art are here so well combined as to give an especial charm to the gardens, and they reflect great credit upon the landscape gardener and others who are concerned in the management. But in addition to all the beauty and benefits so evident on these horticultural grounds, there are fine future prospects arising from the intended development and perfection of a great Arboretum, with Botanic Gardens, by the Park Commissioners, whose recent "resolutions" foreshadow their excellent plans. Extracts from these read as follows:

"Resolved, That the trees newly planted out should be labeled with metallic labels, with the botanic and common names printed thereon.

"Resolved, That in seeking to produce the most pleasing effect to the eye of taste, all planting in the park should keep in view the scientific culture of the pupils of the university, colleges, and schools, and of the people."

The planting of a part of the Arboretum, dedicated to the pine family, has progressed during the summer, and a large number of coniferous plants have been placed in position.

The "Michaux Grove of Oaks" already contains forty-five species, and some distinctly marked varieties. Duplicates of these may be seen in other parts of the park. It is expected that other desirable species will be added before long to the collection of oaks, by means of purchase or exchange from a celebrated arboretum in Prussia. A row of sugar-maples has been planted to embellish each side of Belmont avenue, the finest in the park. American elms may be seen along the main drive from the southern entrance to Girard avenue, and a row of lindens by the river drive, all rather recently set out. There is an interesting magnolia grove of young trees, presented by Mr. Cope, of Philadelphia; this is but a short distance from the conservatory, and is well worth noticing. It embraces about twenty species; the Macrophylla, the Acuminata, Cordata, Halleana, and the rare Hypolenca are among them. There are also other magnolias scattered through the park. In the section known as the Old Park (nearest the center of the city) the planting has included over three thousand trees and shrubs, and twelve thousand plants, within the past thirteen months.

The Plantarium, or Nursery, covers not less than twenty acres (in about the center of the park), where evergreen and deciduous trees and shrubs compose the stock. These are of good size and quality, numbering thirty-three thousand in all. The estimated value of plants presented to the Botanic Garden, by other gardens, at home and abroad, and by individuals, is above six thousand dollars. Many of these are known in commerce as economic plants.

In the Fernery are two hundred species and varieties of ferns, and about twenty-five species of mosses—a larger collection, probably, than will be seen elsewhere in this country, and the design is to increase the number largely by another year. Among the rare and interesting ferns are the stag horn (*Platycerium*), the Irish bristle (*Trichomanes radicans*) from the Lakes of Killarney, the traveling fern (*Asplenium Congissimum*), and others. I would not fail to mention the peculiarly beautiful *Adiantum Farleyense*, with its delicate, feathery foliage of light green. The greater part of this valuable and fine collection was obtained by the purchase of the Australian and Sandwich Island ferns by the Centennial Board of Finance, and by donations and a system of exchanges. They are all in excellent condition.

The Economic Greenhouse displays advantageously many officinal, medicinal, and other plants of botanical interest, which number one hundred, besides a great many varieties. These have all been presented to the city through the commissioners of the park. Banana trees, with their tempting fruit are there (one cluster contained a hundred bananas), and the cocoanut palm; the pineapple, fig, orange, lemon, and an Arabian coffee tree; camphor, ginger, nutmeg, cinnamon, clove, vanilla, and other foreign plants of interest and value far too numerous to be mentioned here. In the main hall of the conservatory is a Brazilian pine thirty feet in height; flowering bananas, a famous sago palm over one hundred years of age, and many large and beautiful tropical plants of a decorative character, growing luxuriantly, it is said, as they do in their native climes.

In the Temperate House, also connected with the conservatory, are placed the half hardy plants during the winter. A collection of Australian plants, including many varieties of eucalyptus, will soon be removed from the grounds to this retreat, and also many other plants that serve to decorate various sections of the park in summer.

The Forcing House, for hot house plants and the propagation of plants by cutting and seeds, is by no means an uninteresting place. Many donations of seeds have been received by the Park Commissioners from different sources during the past year.

Since January, 1877, free botanical lectures have been given in the lecture room of Horticultural Hall, and a course upon "Trees, Forestry, and Sylviculture," by Dr. Rothrock. They were well attended, and are to be continued this autumn on Saturday afternoons. Dr. Rothrock is of the University of Pennsylvania.

As one leaves the hall from the front entrance, and walks on one of the broad promenades, recently surfaced with asphalt for the distance of a thousand feet, he sees the brilliant colors and the many hues of the Coleus, in beds composing the sunken garden, so very beautiful before our autumn frosts destroy it. From these plants thousands of cuttings have been taken for the park beds of 1879.—*New York Observer.*

BEST SHEEP FOR FARMERS.

The best sheep for a farmer to keep are those which yield the heaviest fleeces and the greatest number of pounds of meat. The scrub sheep will yield from three to six pounds of wool per head, while Merinoes will range between ten and twenty pounds, and thoroughbred Cotswolds more. Why is it that the farmers do not raise the sheep which will give these heavy fleeces? Then as to the meat, the fine sheep produces an enormous amount of flesh, and does not eat any more than a scrub. But besides these facts, the fine sheep do not only yield large fleeces per head, but the wool is of a superior quality. The same is true of the sheep in comparison with scrubs.

Southdowns, for instance, are the finest mutton in the world, always commanding an extra price—a flesh which princes desire—while the fleece is medium. The Shropshire stand next in quality, and are next to Cotswolds in fleeces. The profits of these breeds are very great in times of ordinary prosperity, and under all circumstances it is best for the farmer to breed them, because they pay better—the grand result which is the supreme object of the farmer—the highest possible remuneration for his capital and labor.

And all concerning sheep is true of fine breeds of cattle, horses, hogs, and poultry. In the face of these indisputable facts, the mass of the people should not handle scrub stock, and entertain an ignorant opposition to fine breeds.—*Live Stock Record.*

Plants in Flower-Pots.—The use of mustard water for repelling or destroying insects in the soil of flowers-pots has been recently recommended—a tablespoonful of mustard to a gallon of water. A greater degree of strength would probably be more effectual, pungent vegetable matter not injuring plants.

THE CARPET BEETLE, AND OTHER DOMESTIC PESTS.

By DR. H. A. HAGEN.

AT a recent meeting of the Boston Society of Natural History, the following paper on "The Carpet Beetle and Other House and Museum Pests," was read by Dr. H. A. Hagen.

I intend to speak about a most interesting fact in natural history, about the sudden appearance, not to say invasion, of the carpet bug, which some rather ill considered persons have chosen to call carpet pest. Of course, my favorable report can only be considered a minority report, but I think of rather a large minority. Besides the numerous students and amateurs of natural history who will be on my side, I think I shall doubtless have a strong support from the large portion of the population engaged in the manufacture of carpets, or the sale of them; in the large number of people occupied in handling and laying carpets; in the gentler sex, who, with broom and duster, is always ready to clean out our house and to disturb our comfort. Last, not least, we shall have with us the ever eager crowd of inventors, happy to find a chance for some new things, and assiduously occupied in putting together the most nauseous smelling substances to kill the new and overpowering pest.

Six years ago I had the pleasure of a visit to my department in the museum of the late Mrs. W. Ph. Garrison, and, as I endeavored to show and to explain my little six-legged treasures, she asked me if I had the buffalo pest. I acknowledged sorrowfully my perfect ignorance on the subject, and had the promise that a specimen would be sent to me. Several weeks later a phial with little larvæ, carefully provided with some green woollen rags as way food, arrived, and proved directly that the food was very well used, as all that is now called by the more decent name of frass—the old, true name is excrements—was to my utter astonishment as green as the wool. The little voracious larvæ looked not at all strange and foreign to me, and after a few weeks the beetles were raised and proved to be an old European acquaintance—called in the system Anthrenus Trophulariæ. I was told that the insect had given some alarm by destroying carpets, was never known or seen before, and called by the people obliged to buy new carpets earlier than they had hoped to do, in a momentary loss of self-possession, buffalo pest. In the following years the new immigrant tried his best to do the new country, sometimes to the greatest disgust of the old inhabitants.

In 1874 a family in Coldspring, New Jersey, which had a year before suddenly decided to go to Europe, and had left everything standing in the house, returned and found, according to the statement, that the bugs in the meantime had taken complete possession from the cellar to the attic, in every nook and crevice of the floor, under matting and carpets, behind pictures, and eating everything in their way. The fact made some noise in the newspapers, and probably more in the unlucky family. Since that time every year in spring, mostly in June, I had some hurried visits from gentlemen, bringing in a large tumbler a dozen or more living larvæ, and asking in a desperate humor what they represented, where they came from, how to kill them in the quickest manner, besides a number of other questions, accompanied by the sad story of the new intruder and its ungentlemanly behavior. I should state that every year the number of visitors increased, but last summer it grew so large as to be entirely contrary to the laws of probability. Exasperated gentlemen, and even ladies, mostly out of temper, because at the moment of preparing for the country they found everything infested by these larvæ, came hurriedly to ask for help. The fact that the insect had propagated and spread in an extraordinary manner was indubitable. One father had the entire outfit of his recently married daughter destroyed; one gentleman had bought and furnished a new house, and had to begin the same task over again; one lady found all her winter clothes damaged, and what is called somewhere in the suburbs a swell parlor showed before the occupants were aware of it anything but a swell carpet. After carefully investigating the circumstances concerning the discovery of the insect in each case, I traced about three-fourths of the infested carpets to a large store, the proprietor of which had bought a large line, and the carpets were sold cheaper, the only attractive feature about them being their nice appearance on a casual inspection. Then the newspapers took the matter in hand. It was just before the dog days, and nothing sensational before them, and so for a week or two nearly every one had stirring articles about it. As my name had appeared in the papers in connection with the insects, I had the pleasure to be interviewed by day and night, and to receive letters accompanied by mysterious packages, all smelling awfully, and said to be the newest, the most effectual remedy against the insects. They courteously proposed to me to investigate those remedies by living weeks or longer in an atmosphere which the insects were said not to be able to stand—a proposition which I was sorry not to be able to accept.

HISTORY OF THE INSECT.

The interest of the fact, beyond the sad consequences with which I have a sincere sympathy, is the sudden appearance and spreading of an insect over a large part of the United States, which seems doubtlessly imported from Europe. I had first some doubt about the *new* apparition, but the most reliable American authorities for coleoptera affirm never to have met with this species before, except that a variety, also to be found in Europe, was found twenty years ago by Dr. J. L. Le Conte on flowers in California. Collections of North American beetles, sixty to eighty years old, as those of Melshiemer, Ziegler, and Harris, were consulted by me, but none of them contained the beetle, which is, by the way, of such variegated and striking colors that it would hardly be overlooked. In Europe the species is very common everywhere, living on flowers, but its destructive propensities were well known and described more than a century ago. There it likes to enter through the attic windows, and prefers to live on dead flies common in such places. But where it spreads from there through other rooms, it is just as obnoxious as it is here. Every woolen thing, collections of objects of natural history, plants, insects, birds, rawhides, hair, furs, and similar things are quickly destroyed. As carpets are not in use in Europe except in winter time, and then mostly not fastened down near the walls, and as all carpets are carefully stored away during the summer, it has not the chance to be as destructive as here, as just the spring and summer are its most favorite seasons. Nevertheless it is rather difficult to understand that this insect was not introduced earlier, and I think the most probable opinion is that a large lot of infested carpets bought in Europe and imported here has been the first cause of its alarming appearance. If we consider that the insect and its habits were here entirely unknown, it is easily understood that it was first overlooked and then underrated, and so had time to propagate more than it would have had when well known. The beetle, itself entirely harmless, except through its progeny, is small, dull colored anteriorly, with a large white spot on each side, a red dorsal stripe, and on each side three waved, pale bands. The larvæ, the only obnoxious state, is dark blackish, a little longer than one-third of an inch, covered with tufts of black hair, which give to the little animal a rather ferocious aspect, the more as it runs swiftly. The whole course of development is made in about five or six weeks, and then a new generation begins the same career.

HELPS TO PREVENTION.

Of course the appearance of a pest which seems destructive and powerful enough to change customs and fashions of life makes it necessary to think of remedies. In the first terror occasioned by it everything was recommended, principally bad smells. Now I think if anybody should try to drive out of his house all that he dislikes by bad smells, he will finish by being driven out himself; besides that, several of the remedies recommended are certainly not of an innoxious character. Next, the wholesale application of kerosene and benzine was recommended, only five gallons or more for a small cottage. If it is certain that every carpet bug drowned in kerosene or benzine is done forever, I think it is not considered that in the use of those and kindred liquids the insurance companies would have something to say, and certainly not be obliged to pay in case of accident. I know one case in which such things were used with so much effect that nobody, not even the cat, could be induced to enter the rooms for many weeks. I think the best way to be followed would be first to prevent the entrance of the insect. Therefore, every new carpet or rug should be considered as dangerous and treated as the old ones; that is, exposed in the open air, in sunshine if possible, as sunlight the larvæ cannot stand, and strongly beaten before laid in the rooms. The common custom, to order new carpets in the stores and lay them directly in the rooms, is apparently the most dangerous course to be pursued. Further, as it is observed that the beetles by preference follow the cracks in the floor, all should be made tight, or at least filled with tallow. The tallow is a very dangerous substance for the larvæ and eagerly avoided by them, as the fat easily attaches to the spiracles with killing effect. Therefore, the most common candle tallow, being softer, is better than the purified. For the same purpose, I should recommend tallowed paper to be put along the walls, only a foot or two underneath the carpets, as just the places near the walls are their most chosen abode. Of course a careful and more frequent inspection of the carpets will be necessary, if the number of larvæ seems to be in any way alarming. I think it will be impossible to get rid of them entirely, but it will be certainly possible to keep them within limits, so that they will be not more dangerous than any other house pest.

FLEAS AND OTHER INSECTS.

It is an experience since biblical times that if somebody happens to be something of a rogue anything wrong committed by any one else is put on his shoulders. The poor carpet bug is an instance of this. The family of Anthrenus is an old and rather large one, and there exist many cousins in the fifth or later degree who try to prove their relationship in being as obnoxious in the same line, and perhaps more. One arrière cousin, Attagenus Megatoma, is really as common as the carpet bug, despising nothing in his way, and, being more swift and smart, is at least equally injurious. Those beetles have propagated in the last years enormously in houses and collections of objects of natural history. One large beetle in a collection here in Boston harbored alone 150 of these insects. I have, therefore, the conviction that perhaps half of all the damage credited to the carpet bug, and sometimes more, is done by A. Megatoma, the cousin.

Strange enough, another well known insect has during the last few years so much increased as to diminish the comfort of having carpets in the room. I speak of the common flea. Eleven years ago I was rather astonished by the rarity of this insect in New England. For the first two years I had every reason to believe that it did not exist here at all, as I was not able to see or to get any authenticated specimens for the collection. All brought to me were dog and rat fleas. Later I had them sent to me from New Haven, Conn., and finally I got some real Bostonians, as a scientific friend was kind enough to collect them on the floor of the exhibition room of this building, after a visit of a public school. Nevertheless, the insect was decidedly a rare one; a fact the more strange as it was satisfactorily common in New York and in Canada, and more than satisfactorily along the Mississippi in the Western States. I am obliged to confess that I am unable to account for its rarity here, as well as for its sudden increase during the last year, and for its invasion this year. At the same time the cat flea grew exceedingly common. In the suburbs not seldom were seen in the streets cats entirely covered with insect powder, and apparently feeling very comfortable in this ridiculous looking coating. I had sent from Medford, Mass., a phial with eggs, which a lady found on the sofa, on a place where the pet cat used to lie down. From the fact that the whole spot was white, you may realize the enormous number of the eggs, which are less than half a millimeter in length. I gave my attention to it, and in a few days later I was able by hatched larvæ to state that they were really the eggs of fleas. A similar fact was observed by myself.

But, as stated before, not the cats alone had to suffer; the same pest annoyed families in Boston and in the suburbs in a strange manner. Again *paterfamilias* hurried to me for counsel and help. The little enemies are a rather light-footed game, and make the hunting anything but an amusing sport. I think everybody who has spent some time of his life in Italy will never forget his observation and his own experiences in this matter. Perhaps he will remember to have seen a fellow-traveler of a more delicate complexion, whose blood the little creatures preferred, expressing his strongest indignation in every language at his command, and not at all relieved by the comparative immunity of his fellow traveler. I am ashamed to confess that I thought first of a similar arrangement to recommend to the unhappy *paterfamilias*, but I decided it to be out of place. Happily I was not deficient in resources.

POLISH FLEA TRAPS.

The place where I was born adjoins Poland, so I am somewhat informed about this country. Now Poland is the real paradise for fleas; from the lowest servant to the highest aristocracy, male and female—nobody is exempt except the most dirty set, who prefer to cultivate lice. The Poles are usually rather nervous without such a stimulus, and so need more a calming protection. The remedy used there is as simple as effective. On the middle of the floor of the sleeping-room is placed a wash-bowl, in more urgent country cases a washtub, filled with water, and in the middle of it a burning candle. By this little stratagem the poor fleas are attracted to the light and are drowned in the water. I proposed the arrangement, and learned the following morning the water had become black, to the entire satisfaction of the sufferers. If it were possible for such benefits of nature to go on increasing in the same way, the most easily satisfied person will acknowledge it would be a hard case. But happily nature arranges things in such a way that an increase of obnoxious insects is always accompanied by one or more destructive enemies. A hundred years ago the ill-reputed Hessian fly was the horror of the country; now this insect is rare enough to be wanted in many collections. The formidable wheat midge has in just the same way become pretty rare. About 150 years ago the culture of pears had to be stopped here in many places, as the pear weevil made it perfectly useless. Now nobody thinks of it, and if the fact was not retained in the annals of science perhaps it would have been forgotten. Even the canker worm begins to feel uncomfortable through the benevolent assistance of the English sparrow—and the potato bug and phylloxera had to decide to do Europe, as it began to grow too hot here.

INTRODUCTION AND DISTRIBUTION OF INSECTS, WEEDS, ETC.

The question how animals and plants migrate is a very interesting one. Generally the migration took place so long ago that only a conjecture is possible. In fact, nearly everywhere it seems to have been done from the East to the West. Only very few cases in the opposite direction are known; the most remarkable is the well-authenticated travel of the potato bug during the last two years. The common cockroach, originally said to have been an inhabitant of Asia Minor, was 300 years ago first observed in an alarming number in English ships, spread more than 200 years ago from England to France, and 100 years ago more or less slowly, but faster in the time of the Napoleonic wars, through Germany into Russia and into Siberia. These facts are proved by the vulgar names given to the disagreeable animal in different countries. In Germany it is called Frenchman; in Russia, Prussian. But the most disastrous evidence of an Eastern propagation is the ill-reputed phylloxera killing the choicest kind of grape known to mankind. The large prize proposed by the French Government for a remedy against this pest, 300,000 francs, has had only the striking effect of placing in nearly every asylum in France a poor inventor, grown insane by the sure conviction that he has discovered a certain remedy against the pest, and is therefore entitled to the government's fund. I should state that I was strongly urged from Europe to work out the question for the prize, and happily for my faculties declined to do so, though perfectly unconscious of the danger. The comparatively new cultivation of America has shed at least some light about the question of migration. Mostly the new intruders accompanying the emigrants follow strictly their ways and spread now more rapidly along the railroads. Ten years ago in Minnesota, as the train was stopping in the middle of the prairies, I saw some white flowers and hurried to the spot, hoping to find some plant new to me, when I discovered that it was one of the most common European weeds, undoubtedly brought so far by the railway. I made later a careful comparison of the European weeds observed to grow in the United States, and found in Professor A. Gray's flora represented two-thirds of all European weeds, and perhaps some more out of the remaining third. It is a certain fact that in some places the original vegetation changes remarkably by such intruders. Indigenous plants are killed, and not only the plants, but the insects living on them, so that a keen observer, Baron von Sacken, has assured me that particular flies living *exclusively* on certain plants, and twenty years ago common in many places in Virginia and adjoining States, were seemingly rare now, and some species perhaps nearly exterminated.

The introduction of plants is often accompanied with the introduction of insects peculiar to them, therefore many enemies of fruit trees, shrubs, and flowers, formerly not known here, are now common. Such insects are even induced to infest indigenous plants belonging to the same group, or genus, as the imported one. For the same reason plants entirely foreign to a flora, if introduced, remain at first intact.

Besides the well-known larger animals for food and agriculture imported from Europe, every year smaller insects come over. Some butterflies have already made the trip round the world. A large species of fly, well known in Europe by its curious rat-tailed larva, was found here first three years ago, and was this year so common that hundreds were caught. As steamers come over now in a week or two the insects are imported living, and, if possible, go on propagating here. It seems to be a fact that man is followed wherever he goes by such a train; but the whole process of immigration is by no means an incidental occurrence; it is one of the undisturbed and continuous consequences of the progressive development of the world. The fashion for entomologists is at present to credit to Europe a large number of insects imported here, and mostly of an obnoxious character. But I think it should not be forgotten that many of them are by no means originally European species. They were imported there from the East, as well as here, but, owing to the Atlantic—which they were unable to cross alive except in comparatively recent times—they had stopped so many centuries in Europe as to be considered as indigenous species. The Hessian fly and the wheat midge are imported from Asia into Europe with the cereals upon which they live. The oyster-shell bark louse, the grain weevil, the rice weevil, the asparagus beetle, and many others are similarly imported through the advance of mankind and culture.

The celebrated geographer, Carl Riker, has tried to work in an ingenious way about the question of the course which certain plants have taken in their wanderings. In a memorable paper about sugar he has collected every name in every country given to sugar, to the plant, and to all that is made of it. In comparing the root of the names he arrived at the result that the wandering must have commenced in India. Later I tried the same method for the well-known white ants, and found to my greatest surprise that the roots of the name are the same in Sanscrit, Greek, Latin, Anglo-Saxon, and also in the aboriginal language in the West Indian Islands, and in some way in the Malay languages of the Pacific Ocean. As in these times enthusiasts assure us that out of the Gaelic language all others, even Sanscrit and Hebrew, have originated—a fact which would in some way prove that to this people belonged the couple driven out of the Paradise, I was not able to go back to the center of distribution for this name, perhaps owing to my unfortunate ignorance of the Gaelic language.

CLEOPATRA.

WE publish an engraving of a work of Henry Braga, the Milanese sculptor. It represents in marble Cleopatra as she appeared before Cæsar in the flower of her youth and beauty. The Roman conqueror, of whom Suetonius spoke as *virum omnium mulierum*, succumbed easily to the fascinations of the royal African.

This statue of the Egyptian Queen, whose beauties her handmaid has just bared for the conqueror of the world, is a noble monument. At Philadelphia and Paris alike it excited the admiration of the jury. No subject supplies a more certain spring of perennial inspiration to artists in all branches of art than the lovely woman whom fate placed in the forefront of the most tremendous events, who was an ally and an enemy of Rome in the zenith of the Roman power, had Julius Cæsar and Mark Antony for lovers, and Augustus for a foe, gold and purple for her life, an asp's bite for her death, Horace, Shakespeare, and Swinburne for her poets. The strongest proof of the undying interest which this once beautiful woman excites when 2,000 years have numbered her with the dead is that in the present season we have seen a wonderful monolith brought from Egypt to England which will for ever keep her name on the lips of the least learned of the inhabitants of London. The obelisk is older than Cleopatra, but the Arab tradition, fastening on one intelligible bit of romance in preference to all conjecture about the dreary hieroglyphic record of bird-headed kings and enigmatical triumphs, called it her needle; and so Cleopatra's name will now be associated with it where it stands beside the dull and foggy river of which she may have heard strange tales as she reclined with Cæsar on the burnished poop of her trireme on the Nile.—*Ill. Paris Exhibition.*

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(To be continued.)